Heating Piping & Air Conditioning

NOVEMBER 1956

INDUSTRIAL • COMMERCIAL • INSTITUTIONAL • PUBLIC BUILDINGS

Journal Section of the American Society of Heating and Air-Conditioning Engineers—p. 137

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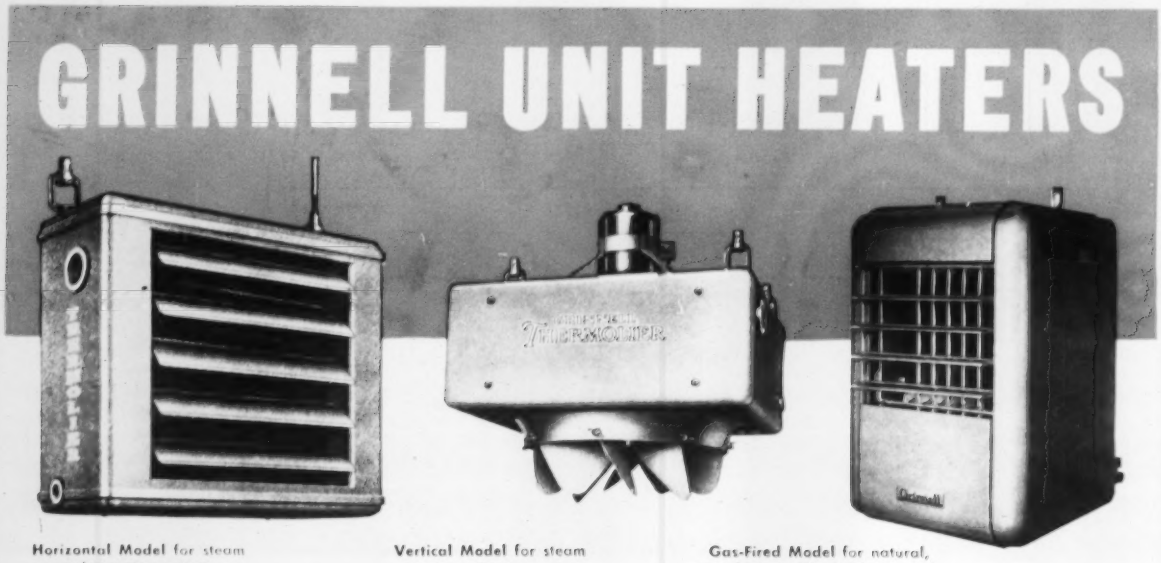
New industrial steam pipe line of The Detroit Edison Co.'s Delray electric generating plant supplies 390 psig steam to customers within 1½ miles . p. 102

For Maximum Heating Comfort, Economy, and Flexibility...

Grinnell Unit Heaters bring you many unique design and construction features, coupled with important advantages in comfort, economy, and ease of heating. Heat comes fast, even from a cold start — and is spread uniformly to all parts of the working area. It is not allowed to bank up uselessly under the ceiling. Units are compact. And, both unit and the simple piping are overhead, out of the way, easy to relocate if necessary. Heating capacity often exceeds that of other types costing twice as much.

GRINNELL UNIT HEATERS



Horizontal Model for steam or hot water systems.

Vertical Model for steam systems.

Gas-Fired Model for natural, manufacturered, mixed, LP gases.

GRINNELL THERMOLIER
Steam Hot Water Unit Heater
4 models . . . 18 sizes — from 35,600 to 275,300 total heat delivered, Btu per hour

Three basic models—horizontal, vertical, and a special horizontal Textile model. (Adjustable velocity nozzle also available for use on horizontal models.) All models have plain thermostatic trap, the simplest and least expensive kind of a trap, made practical because of unit's exclusive internal cooling leg; maximum capacity provided and destructive water hammer eliminated by built-in pitch of tubes. Many other important features.

GRINNELL
Gas-Fired Unit Heater
Available in 7 sizes — ranging from 25,000 to 200,000 Btu per hour input

Grinnell Gas-Fired Unit Heaters are easy to install, simple to operate and maintain. Efficient performance is assured — with any type of gas — by modern design of burners and heat exchanger, proper motor and fan unit. Automatic safety pilot operates to shut off main gas supply if pilot goes out. Flashback and extinction noise prevented by the burners' raised port design and proper port size for the gas used. American Gas Association approved.

Available from your local distributor

Grinnell Unit Heaters are backed by over 60 years of heating experience, and proved by trouble-free service in countless installations. They are distributed by a coast-to-coast network of plumbing and heating jobbers . . . and in over 30 principal cities, Grinnell engineers can offer on-the-spot advice and help on your heating problems. For new buildings, or for modernizing existing heating systems, it makes good sense to call on Grinnell first — for the unit heater that will meet your specific needs.

GRINNELL
WHENEVER PIPING IS INVOLVED

Grinnell Company, Inc., Providence, Rhode Island

Manufacturer of pipe fittings • welding fittings • forged steel flanges • steel nipples • engineered pipe hangers and supports Thermolier unit heaters • Grinnell-Saunders diaphragm valves • prefabricated piping • Grinnell automatic fire protection systems

Here's why Wrought Iron Pipe serves longer at lower cost-per-year

Wrought iron pipe's longer life comes from its unique composition and structure. It is a two-component metal . . . high purity iron and glasslike iron silicate. The iron silicate is distributed throughout the iron in the form of threads or fibers. There are more than 250,000 fibers per sectional square inch.

These same fibers, illustrated in the magnified section above, give wrought iron its built-in protection against corrosion. When corrosion attacks, the network of these defensive fibers quickly arrests pitting and rapid penetration. As a result, corrosion is forced to spread out over the entire surface instead of penetrating the pipe wall, as happens in other materials. This effective safeguard against corrosion means that wrought iron pipe lasts longer at lower cost-per-year.

Service records in a variety of installations support this longer-life reputation of wrought iron pipe. Some of the applications where wrought iron is serving and saving are: heating system piping; air conditioning and refrigeration piping; water supply piping; sanitary system piping; sewage plant services; electrical conduit.

More of this story, and why you can use wrought iron pipe with confidence, is told in our booklet, *The ABC's of Wrought Iron*. Write for your copy today.

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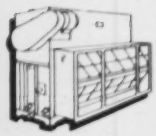
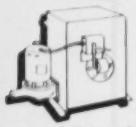
Need more training to hit top bracket? Step into experience and a bright future with the leader in America's fastest growing industry.



Air Conditioning Units

Cooling Towers and Evaporative Condensers



Condensate and Vacuum Pumps

Refrigeration Unit Coolers

Unit Heaters

Baseboard and Convectors

Steam Specialties

JOB APPLICATION PRIORITY ATTENTION

NAME ..... DATE .....

ADDRESS ..... CITY ..... STATE .....

PHONE ..... MARRIED OR SINGLE ..... NO. OF DEPENDENTS .....

DATE OF BIRTH ..... U. S. CITIZEN ..... AVERAGE YEARLY EARNINGS .....

ENGINEERING DEGREES ..... COLLEGE ..... DATE .....

BUSINESS RECORD (Last Position First)

NAME OF FIRM	ADDRESS	TYPE OF BUSINESS	POSITION	DATES—FROM—TO

REFERENCES

NAME	OCCUPATION	ADDRESS	PHONE NUMBER

POSITIONS AVAILABLE IN THE FOLLOWING CITIES. CHECK PREFERENCE:

HEATING AND AIR CONDITIONING SALES ENGINEERS		REFRIGERATION AND AIR CONDITIONING SALES ENGINEERS		APPLICATION ENGINEERS (SALES ENGINEER TRAINEE)
☐ Minneapolis	☐ Chicago	☐ Kansas City	☐ Vancouver	☐ Marshalltown
☐ Philadelphia	☐ Wichita	☐ Baltimore	☐ Washington	☐ Hartford
☐ Baltimore	☐ St. Louis	☐ Oklahoma City	☐ Cleveland	☐ Michigan City
☐ Detroit	☐ Oklahoma City	☐ Toronto	☐ Albany	
	☐ Los Angeles	☐ Montreal	☐ Dallas	

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AIR CONDITIONING, REFRIGERATION, HEATING PRODUCTS AND ACCESSORIES

Heating Piping & Air Conditioning

Vol. 28 No. 11

NOVEMBER 1956

(with which is merged the Aerologist)

DESIGN, INSTALLATION, OPERATION AND MAINTENANCE IN INDUSTRIAL, COMMERCIAL, INSTITUTIONAL AND PUBLIC BUILDINGS

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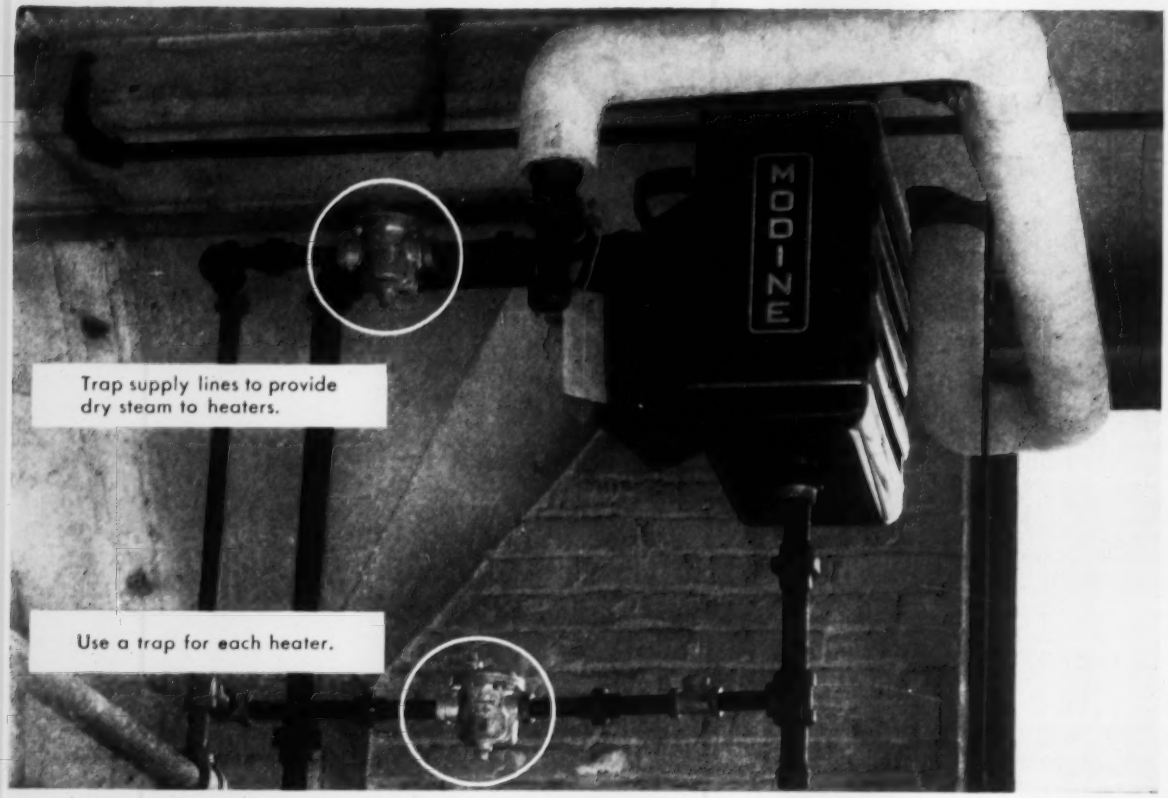

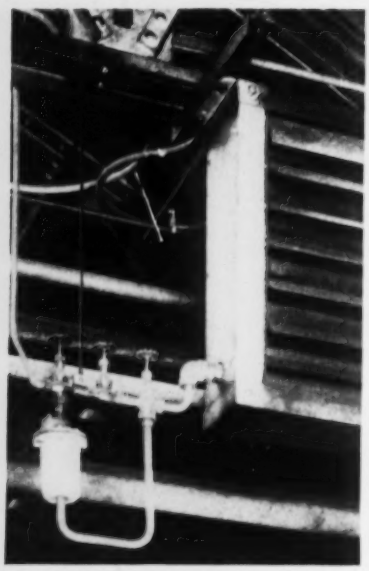

Use a bypass above trap where heater must be kept in operation at all times. Note neat hookup possible with Armstrong vertical connection trap.

Tips on Trapping Unit Heaters for Full Output and Low Maintenance

• If unit heaters are clean and the steam supply and return lines are adequate, their performance will depend entirely upon the steam trapping. Here are some trapping pointers to insure plenty of heat when it is needed:

1. Trap supply lines to take care of condensate formed by radiation loss.

2. Use one trap for each heater. Two or more heaters drained by a single trap will fail to deliver maximum btu output.

3. Size traps properly. Many a unit heater is handicapped by a trap lacking adequate condensate and *air* handling capacity. The few dollars extra for larger traps insure fast heatup, full output and freedom from coil corrosion.

4. Install traps correctly. Put trap below and close to heater. Install a bypass around the trap if the heater must be kept in operation at all times. A shut-off valve in the discharge line facilitates trap inspection. Use of check valves and strainers is dependent upon piping conditions and the traps used.

5. Protect against PRV failure where freezing could occur. Sometimes heaters supplied with reduced pressure steam are installed where freezing could occur if traps failed to open. In this case select traps that will open at maximum steam supply pressure and still have adequate capacity at reduced pressure.

FREE ON REQUEST—COMPLETE INFORMATION on the above points, diagrams, selection data, tables and additional recommendations are contained in Armstrong Bulletin No. 2312. Also includes BTU output ratings for all models of 30 makes of unit heaters. Call your local Armstrong Factory Representative or write:

ARMSTRONG MACHINE WORKS
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STEAM TRAPS FOR EVERY REQUIREMENT — APPLICATION ENGINEERED

ARMSTRONG STEAM TRAPS

WHAT KIND OF A BUYER ARE YOU?

If you buy air filters on PRICE

consider this:

FAR-AIR filters will save you enough over "cheap brands" to pay for your original filter investment many times over. You get reasonable first cost... and lower maintenance costs for many years.

If you buy air filters on PERFORMANCE

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FAR-AIR filters handle more air with greater efficiency and less pressure loss. When you select the filter you need from the FAR-AIR line, you are assured of getting the most practical solution for your particular dust problem.

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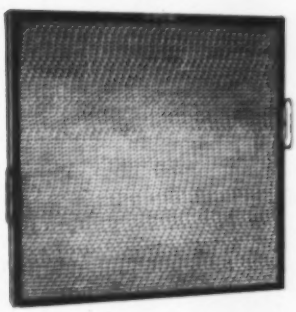
consider this:

FAR-AIR filters are built up to a standard, not down to a price. There is no compromise on quality materials, features or workmanship. FAR-AIR filters invite comparison.

If you are from "MISSOURI"

consider this:

Farr field engineers, by actual tests on *your* filter bank under *your* operating conditions, will prove to *your* satisfaction that FAR-AIR filters will give better performance *and* save you money. We make no casual claims — only request the opportunity to *prove* our points.



So, no matter how you buy, you'll find it good business to buy FAR-AIR. We can show you specific cases in practically any part of the country, and on almost every kind of application, where FAR-AIR products are doing a better job at a lower cost. *Write us for details.*

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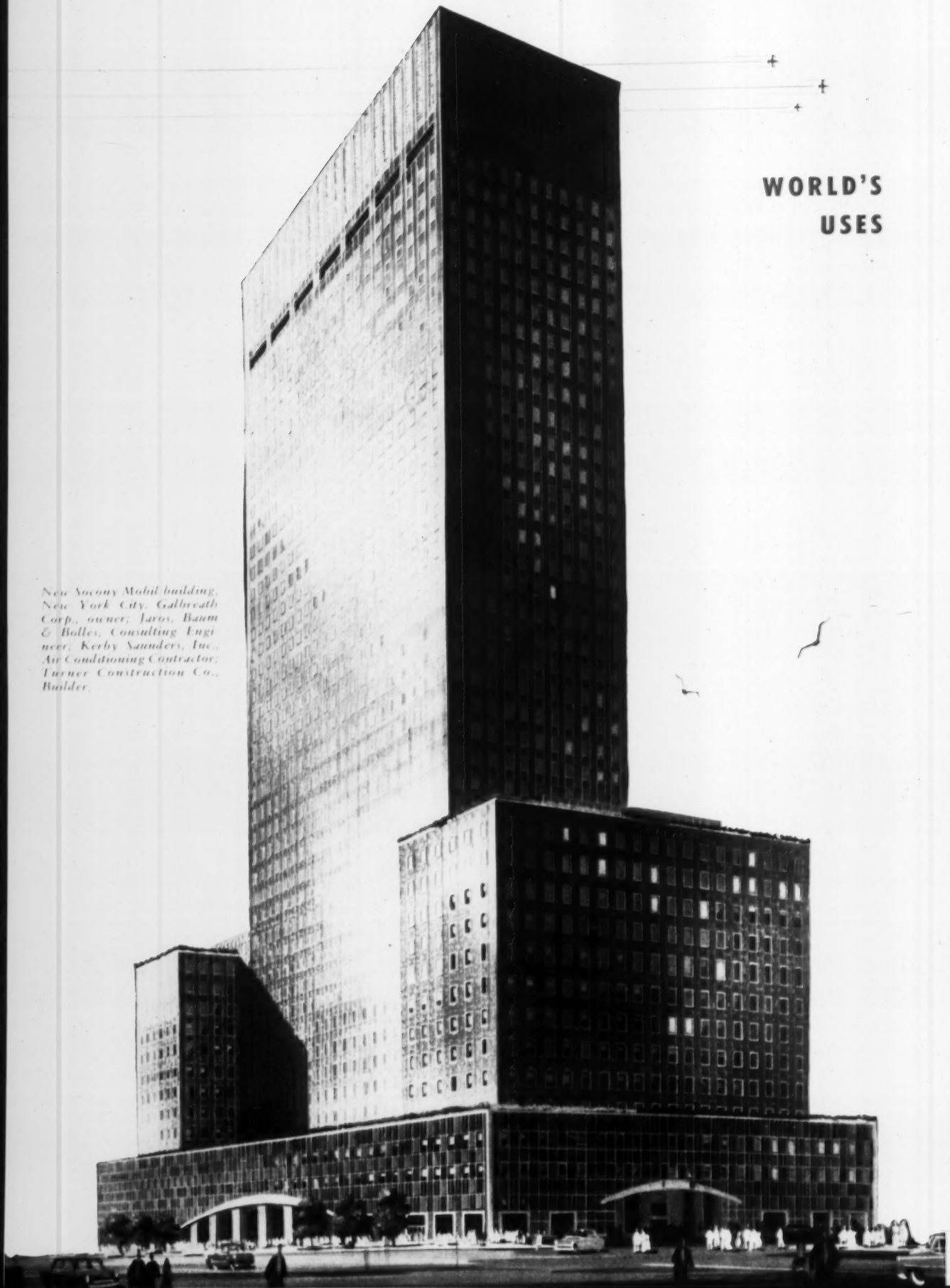
USES



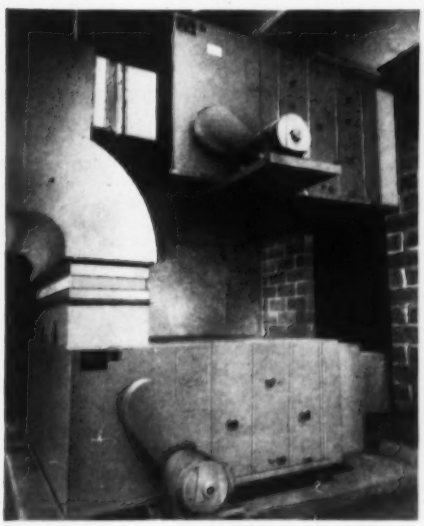
New Socony Mobil building, New York City. Galbreath Corp., owner; Jaros, Baum & Bolles, Consulting Engineer; Kerby Saunders, Inc., Air Conditioning Contractor; Turner Construction Co., Builder.

LARGEST AIR CONDITIONED COMMERCIAL OFFICE BUILDING
75 FANS, 22 CONDITIONING UNITS BY "BUFFALO"

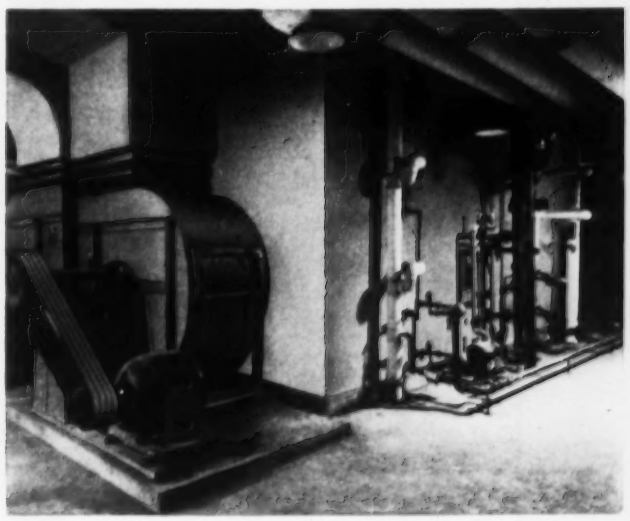
A new landmark at Lexington and 42nd St., New York, the Socony Mobil building is a model for office buildings of the future. It is the largest fully air conditioned commercial office building in the world — the largest built in New York in a quarter-century. Offering so much to tenants, it is little wonder that its 1,300,000 square feet were virtually 100% rented before completion.

Selection of "Buffalo" for all the fans and many of the conditioning units reflects the confidence which engineers, owners and contractors have placed in "Buffalo" for the past 79 years. You will find "Buffalo" air handling equipment in outstanding plants, hotels, institutions, stores and public buildings throughout this hemisphere. And everywhere, you will find it performing to satisfaction, because "Buffalo" builds the "Q" Factor* of Quality into every unit. If you have a job for air, write "Buffalo" into the plans to insure the results you want.

"Buffalo" Type BL Fans handle air in Socony Mobil building. These fans (some of them 13 feet high) plus "Buffalo" Axial Flow Fans and "Buffalo" Shortboy Ventilation Units move all the air. PCLW Dehumidifiers, Humidifiers and PC Air Conditioning Cabinets process the air for various zones.



2 of 4 "Buffalo" PC Comfort Conditioning Cabinets providing controlled climate for certain areas of Socony Mobil building. These horizontal models may be suspended as shown, saving space. The two units not shown are vertical models. All are of "Q" Factor construction, including built-in "Buffalo" Fans, "Buffalo" Pumps, Aerofin coils and heavy-gauge paneling.



**The "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.*

"Buffalo"

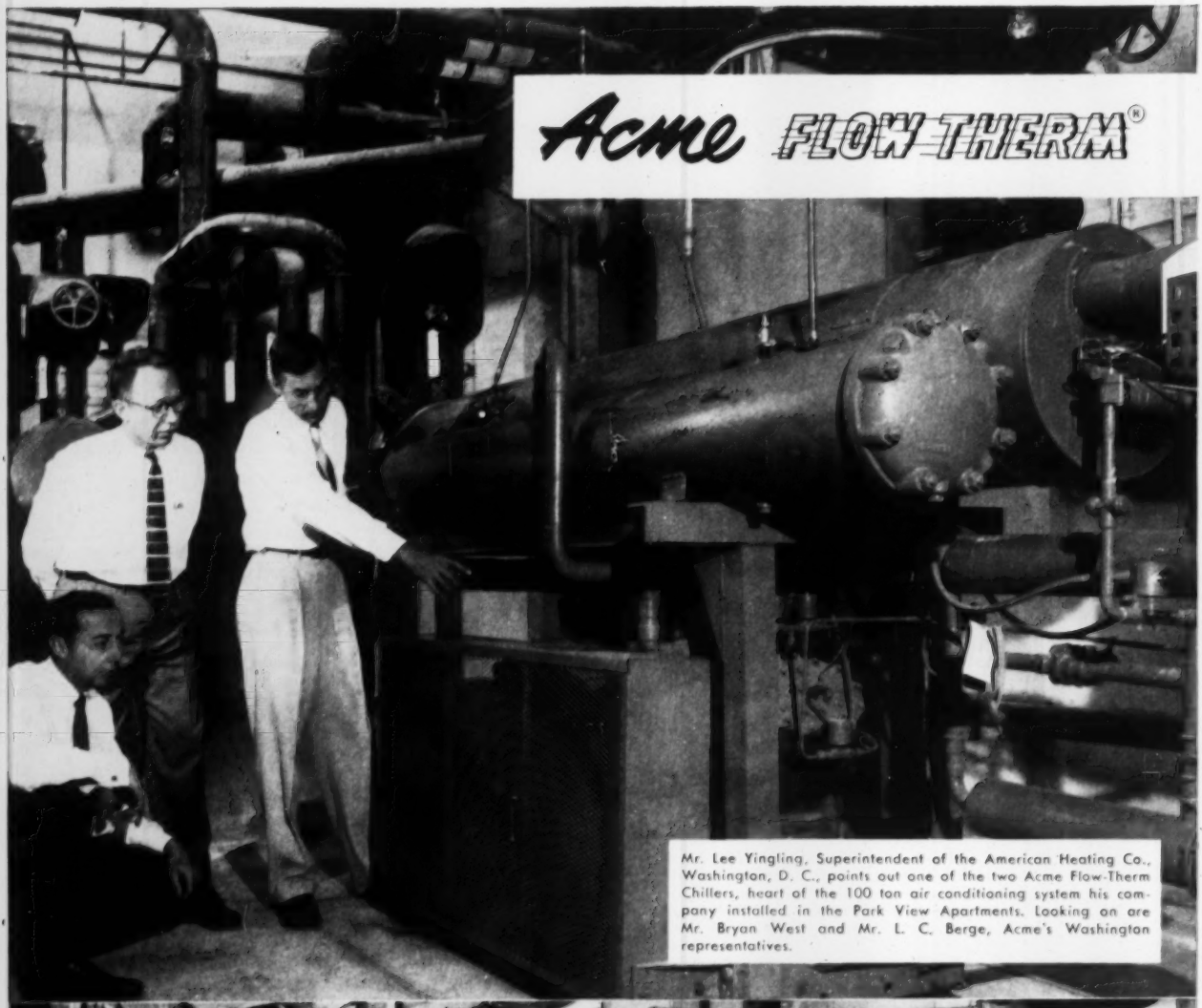
BUFFALO FORGE COMPANY

BUFFALO, NEW YORK

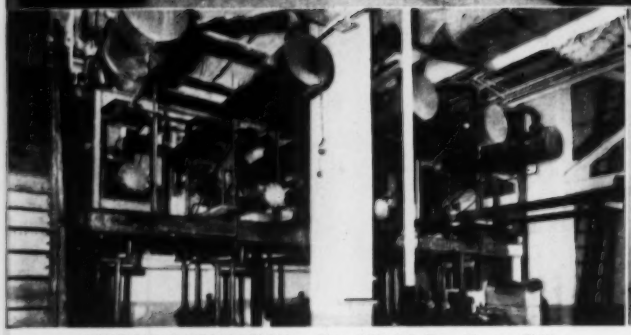
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT EXHAUSTING FORCED DRAFT COOLING HEATING PRESSURE BLOWING

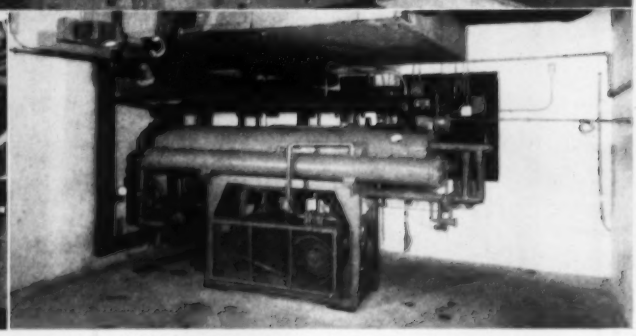
Acme FLOW-THERM®



Mr. Lee Yingling, Superintendent of the American Heating Co., Washington, D. C., points out one of the two Acme Flow-Therm Chillers, heart of the 100 ton air conditioning system his company installed in the Park View Apartments. Looking on are Mr. Bryan West and Mr. L. C. Berge, Acme's Washington representatives.



MULTIPLE INSTALLATION — Five 100 HP Flow-Therm Chillers provide the Merchants Bank Building, Indianapolis, Indiana, with 500 tons of air conditioning. This system was engineered and installed under the supervision of Mr. John Beaulieu, Illingsworth Construction and Engineering Co., Indianapolis.



HEAT PUMP INSTALLATION — Merchants Bank of Miami, Florida, utilizes this 30 ton Flow-Therm Heat Pump for year-round heating and air conditioning. The system was engineered and installed by F. H. McDonald, Inc., in cooperation with Norman M. Giller and Associates, Architects.

ACME AIR CONDITIONING REFRIGERATION

Acme INDUSTRIES INC., Jackson, Michigan

Manufacturers of Quality Air Conditioning and Refrigeration Equipment since 1919

PACKAGED CHILLERS | PACKAGED HEAT PUMPS | EVAPORATIVE CONDENSERS and COOLING TOWERS | ROOM CONDITIONERS

the truly *FLEXIBLE* Packaged Chiller

Park View Apartments look to Acme for air conditioning comfort that sells

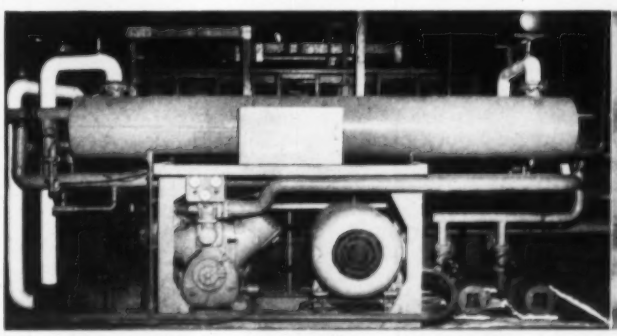
To insure the continuing popularity of their new Park View Apartments, Washington, D.C., Dan Pollin, Inc. insisted on having the most reliable air conditioning system possible. General Engineering Associates, consulting engineers for architects Berla and Abel, specified Acme . . . and with good reason. They wanted a system that would deliver full capacity for peak loads throughout Washington's long air conditioning season – they wanted a packaged chiller with proven dependability, one that was compact and economical to install. They knew an Acme Flow-Therm qualified in every respect.

With Acme you get a more complete range of models, with capacities to fit exact job requirements. This is possible because the Flow-Therm's chief components, famous Dry-Ex Chiller and Shell-and-Tube Condenser, can be tailor-made to match compressor performance exactly – combine operating economy with maximum capacity. The Flow-Therm is the most completely engineered packaged unit in its capacity range. All controls – electrical and mechanical — are supplied complete and ready for simple installation. When you buy an Acme Flow-Therm Packaged Chiller, it arrives on the job completely assembled, ready for connection to power and liquid lines.

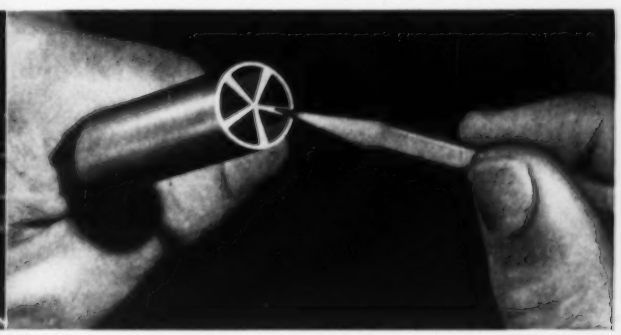
In addition to the normal factory tests for leaks and mechanical defects, all Acme packaged chillers are tested under full load conditions before leaving the factory. Every unit must perform satisfactorily at its nominal rating. Your guarantee of this tested operation is the new Acme Certificate of Performance, first in the industry. This assures the engineer and contractor, who specify and install Acme equipment, that Acme means *dependability*.

Acme Certificate of Performance issued on all Flow-Therm and Flow-Cold packaged liquid chillers, 3 through 150 tons.

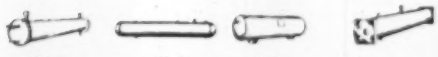
PROVEN FLEXIBILITY – Acme Flow-Therm Packaged Chillers have been proven in varied types of installations throughout the country. They have met all air conditioning, heat pump, and industrial processing requirements. Flow-Therm chillers are available in models complete with compressor, in a range from 20 through 150 tons – up to 300 tons for installations requiring remote compressors.



PROCESS COOLING INSTALLATION — This 100-ton Flow-Therm Packaged Chiller and a Dry-Ex fluid-to-fluid Heat Exchanger is cooling Zinc Cyanide Plating solution at Ford Motor Company's Sandusky, Ohio plant. Installation was handled by Udylite Corporation under the supervision of J. K. Rawsthorne, Sales Engineer for J. Geo. Fischer & Sons, Detroit, Mich.



EXCLUSIVE FEATURE — Key component of the Acme Flow-Therm — the Dry-Ex chiller — contains STAR-INSERT TUBING, an exclusive design that more than doubles the heat transfer surfaces . . . gives more chilling capacity.



DRY-EX LIQUID CHILLERS | LIQUID RECEIVERS | HEAT EXCHANGERS | CONDENSERS

Clip this coupon and attach to your letterhead, to receive your new Acme Flow-Therm Catalog.

UNIFORM THREADING OF YOUNGSTOWN PIPE

makes your job easier, quicker

. . . yet more efficient

7 Points of uniform goodness in YOUNGSTOWN PIPE

- uniform ductility
- uniform lengths
- uniform threading
- uniform weldability
- uniform wall thickness and size
- uniform strength and toughness
- uniform roundness and straightness

Pipe fitting can be trouble free when threads are perfect. Couplings, tees, elbows roll on smoothly with no effort, tighten up with leakproof sureness. There aren't any stoppages or delays--no rattled nerves, no skinned knuckles, no recut threads. You've a quality job and satisfied customer.

You'll appreciate the uniform threading point of goodness -- like the other 6 points of uniform goodness -- in Youngstown Pipe. That's why it will pay you to specify Youngstown for all your pipe needs.

Youngstown PIPE

QUALITY YOUNGSTOWN SERVICE

THE YOUNGSTOWN SHEET AND TUBE COMPANY

Manufacturers of Carbon, Alloy and Yoloy Steel

General Offices Youngstown, Ohio District Sales Offices in Principal Cities

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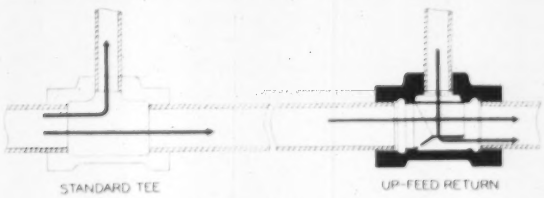
B & G MONOFLO FITTINGS

FOR

Correctly Balanced

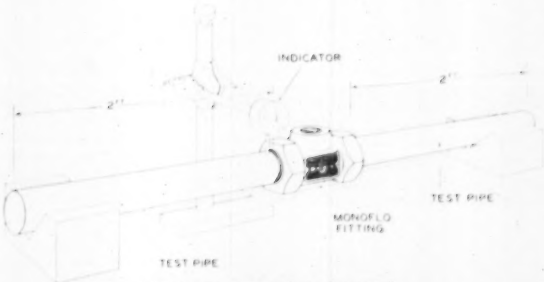
ONE-PIPE
FORCED HOT WATER
HEATING SYSTEMS



Only one fitting needed in most cases

Under average conditions, *a single Monoflo provides ample diversion capacity!* Only in abnormally long pipe runs or where unusually large heating loads must be handled, may a Monoflo Fitting be required at both supply and return risers.

B&G Monoflo Fittings may be installed in either the supply or return riser with equally satisfactory results.



Precision tapped and tested

B&G Monoflo Fittings are made with special machines which tap the threads with extreme accuracy. They are tested in a sensitive gauge by statistical check procedures which assure uniformity of product. Hence installation is always easy, with no "cranking" of pipes.

SAVE TIME...CUT COSTS... PREVENT TROUBLE

with this Engineered Diversion Fitting

B&G Monoflo Fittings enable you to design a one-pipe forced hot water heating system with assurance that it will be correctly and efficiently circulated. That's because the Monoflo Fitting is an *engineered* device—not just a "scoop", or "choke".

These Fittings are designed to handle definite radiator sizes, maintain proper temperature drops and permit the use of economical riser sizes. They provide adequate diversion under average conditions *without introducing excessive resistance.*

No limit to number of Monoflo Fittings in a circuit

An exclusive feature of B&G Monoflo Fittings is that there is virtually no limit to the number which can be installed in any circuit of a one-pipe forced hot water system. Design problems which otherwise occur are eliminated.

By using one or two Monoflo Fittings, depending upon the size of the heating unit and its distance from the main, an accurately balanced system is achieved. (*In most instances, only one Fitting is required.*)

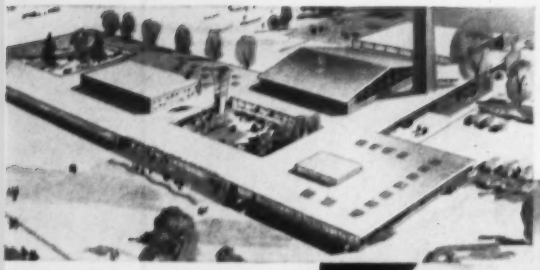
Complete design procedure for B&G Monoflo heating systems is found in the B&G Handbook.

BELL & GOSSETT
COMPANY

Dept. EO-5, Morton Grove, Illinois

Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, W., Toronto

POWERS Control



One of 8 Wyandotte schools using Powers Temperature Control.

"A School Without Study Halls or Homework; each class period is used partly for study, and the ideal is to make the work so engrossing for students that they will pursue it voluntarily."

The building surrounds two courts or patios, one of which is shown at right. It has sheltered tables with benches, planting beds and a sundial.

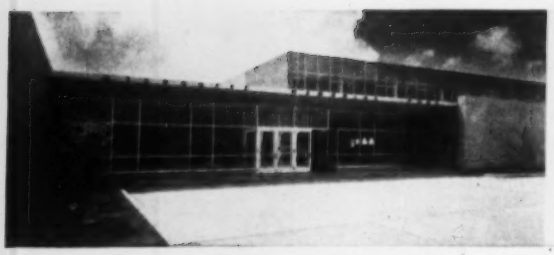
The old bell served the previous Lincoln Junior High School for 50 years.

ABRAHAM LINCOLN JUNIOR HIGH SCHOOL, Wyandotte, Mich.

Architects and Engineers: EBERLE M. SMITH ASSOCIATES, Inc., Detroit

Heating Contractor: L. L. McCONACHIE COMPANY, Detroit

Right: Powers Recording Psychrometer provides chart records of dry bulb and wet bulb temperatures.



Below: Wyandotte Memorial Pool, Wyandotte, Mich.

Architect: ROBERT L. SVOBODA, Detroit

Mechanical Engineer: THOMAS J. BLACK, Detroit

Heating Contractor: GLANZ & KILLIAN, Detroit, Mich.

(C 80)

...used in this school "planned for effective learning"

Among its many noteworthy features the Abraham Lincoln Junior High School has FLEXIBILITY... to permit altering classroom size to accommodate future curriculum changes. Classrooms have non-load-bearing partitions which can be relocated. Heating and ventilating is supplied from prefabricated acoustical radiant ceiling panels which can be rearranged to permit future changes.

Versatility of Powers Temperature Control is demonstrated in this outstanding school and the natatorium shown below.

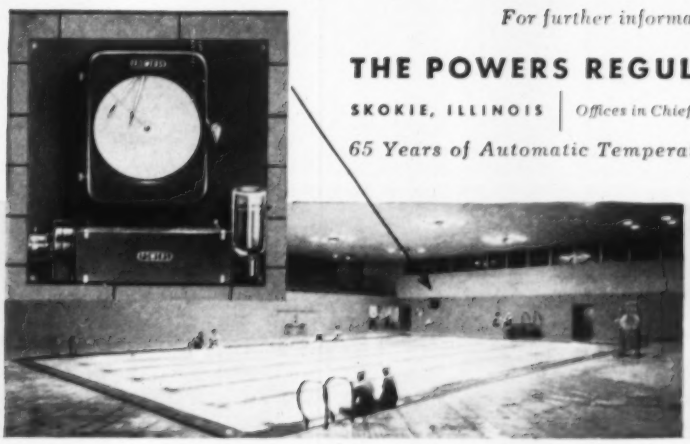
The heating and ventilating system is divided into six zones depending on function of each area. The Powers control system permits normal daytime operation of any zone or zones while the balance of the building remains on economical night control.

Individual Room Control—Each room is equipped with a Powers Day-Night thermostat which modulates a Powers *packless* valve on the ceiling radiant heating coil. A Powers MASTROL system regulates the temperature of the forced hot water supplied to the ceiling coils. The classroom ceilings consist of perforated snap-on metal pans suspended from radiant heat coils above which a glass fiber blanket provides insulation and acoustical absorption. The space between is an air plenum from which ventilating air is forced through the ceiling perforations into the classrooms.

Powers PACKLESS Valves a Must—They prevent leakage of water on ceiling and eliminate packing maintenance. Because they have no packing nut or gland to be tightened, oiled or adjusted, there is no binding of valve stem and they give better control.

Ventilation is regulated by Powers controlled fan units located throughout the building.

If You Are Planning a New School or remodeling an old one, ask your architect or engineer to include a Powers Quality system of temperature control. You will help insure utmost comfort and lowest upkeep cost.



For further information contact our nearest office

THE POWERS REGULATOR COMPANY

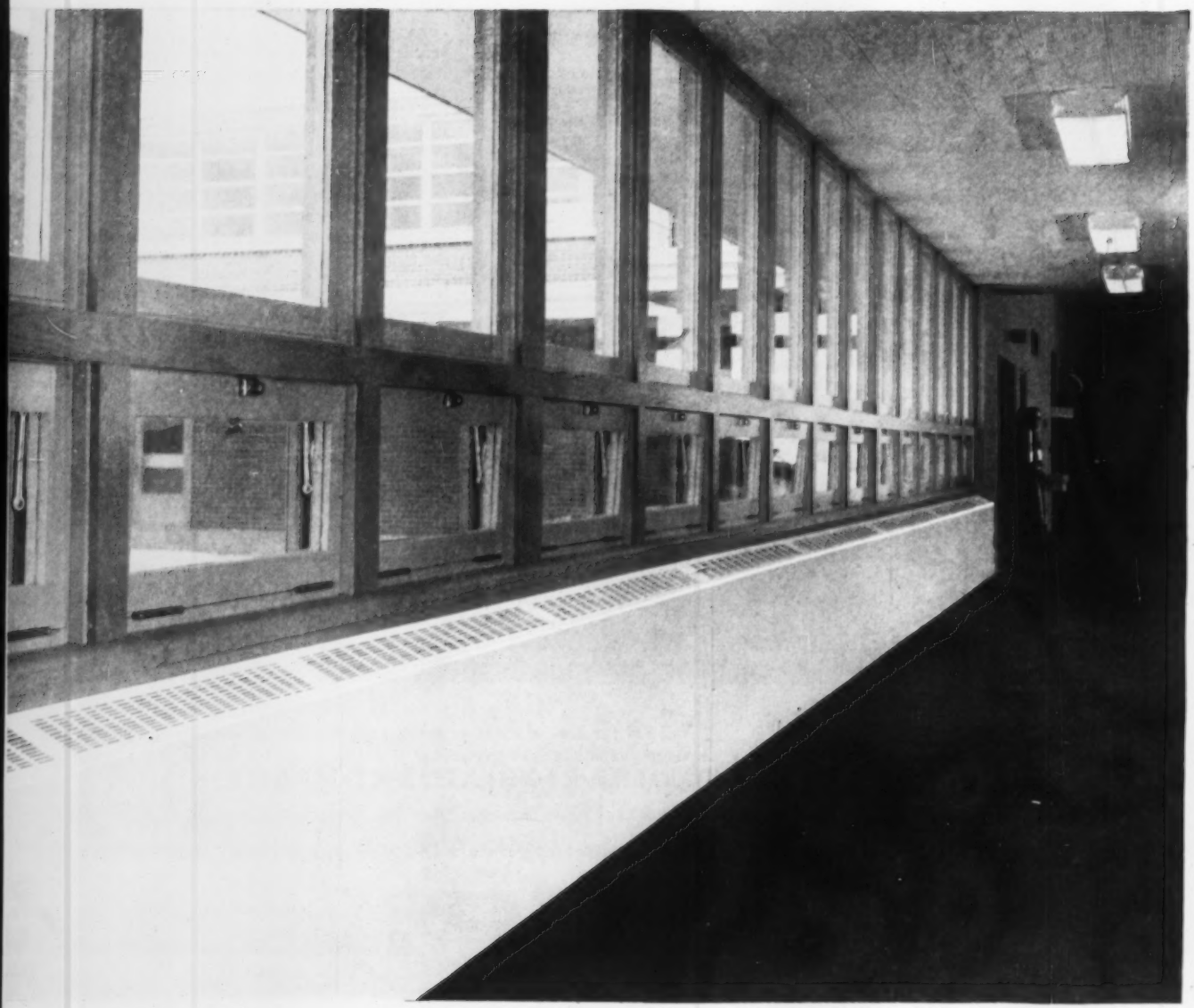
SKOKIE, ILLINOIS | *Offices in Chief Cities in U.S.A., Canada and Mexico*

65 Years of Automatic Temperature and Humidity Control

POWERS CONTROL

Unique Indoor-Outdoor Pool—was built by the City of Wyandotte adjacent to the Lincoln School. Both share its cost and year 'round use, resulting in big savings. Note the large sliding glass doors opening in summer to outdoor sundeck. Heating and ventilating and pool water temperatures are thermostatically regulated by a POWERS CONTROL SYSTEM.

. . . Say "Trane"—and



Trane Wall Line Convectors combine *low initial cost* with *low installation cost* to meet even the tightest heating budgets. Designed for attractive wall-to-wall applications in schools, office buildings, hospitals and institutions . . . wherever *high capacity* and *economy* are a must. Unusually rugged construction with extra reinforcements and full back. Over-all cabinet heights 14", 20", 26"; depths 4" and 6"; lengths to 72".

fill any radiation need!

Nation's most complete line of fin-type radiation simplifies specifications and maintenance . . . concentrates responsibility.

CHURCH ROOM OR CLASSROOM, hospital, home or factory—no matter what type of building or where—*no matter what type of radiation*—this one-source supply can cut design time and help you plan better.

Specifications are simplified, maintenance made easier. And the reason is simple. TRANE manufactures the nation's most complete line of fin-type radiation, so *you* can concentrate responsibility in *one* reliable source.

Since 1925 TRANE has led the way in developing and improving a broad line of radiation products. You can depend on TRANE quality and TRANE ratings in job after job after job. TRANE product literature is complete, easy to use.

So on your next job—say "TRANE." Call your nearby TRANE Sales Office, or write TRANE, La Crosse, Wisconsin.

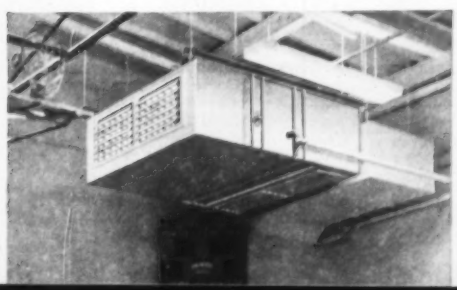
For heating, cooling, ventilating . . . for any air condition, turn to

TRANE

MANUFACTURING ENGINEERS

THE TRANE COMPANY, LA CROSSE, WIS. • EASTERN MFG. DIV., SCRANTON, PA.
TRANE COMPANY OF CANADA, LTD., TORONTO • 90 U.S. AND 18 CANADIAN OFFICES

New Trane Torrivent heats and ventilates large areas in commercial, institutional and industrial buildings. Supplies warmed, filtered, humidified and tempered air mixed in any desired proportion with outside air. Available in free-standing, wall-hung or ceiling models for use with or without ducts. Sizes to 33,000 cfm.

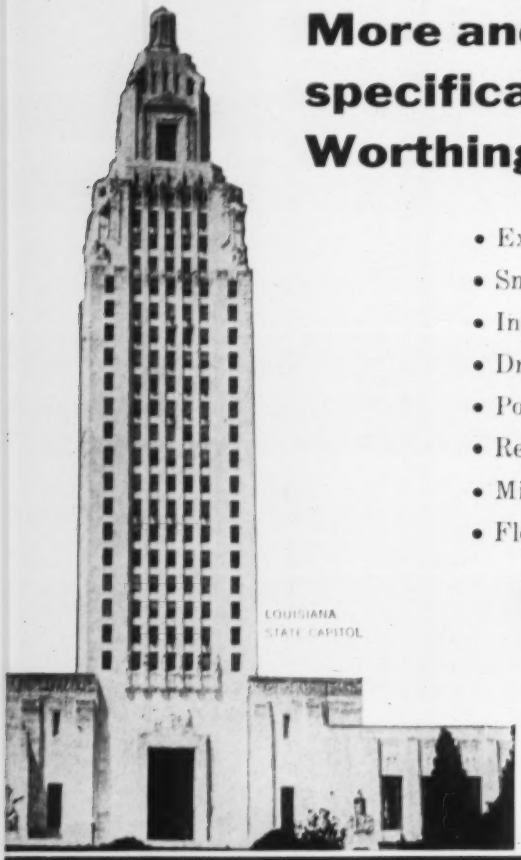


Trane Wall-Fin brings draft-free heating to long wall and window areas. Large tube diameters make it especially suitable for loop systems where pressure drop is critical. Use single element where capacity requirements are low, multi-tiered elements where high capacity per lineal foot is required. Sloping-top cabinets or expanded metal grilles. Choice of 1¼" or 2" steel or 1" or 1¼" nominal copper elements.

Trane Convectors combine efficiency with compactness and beauty. Aluminum-copper heating element responds quickly, provides heat instantly . . . eliminates wasteful overheating common to other types of radiation. Ideal for homes, offices, institutions. Can be installed free-standing, recessed or wall-hung. 21 cabinet styles with flat or sloping tops. Knob or chain dampers optional.

Trane Baseboard Convectors assure your homeowner clients greater comfort by heating where the cold begins—along *outer* walls, *under* windows. Give greater freedom of furniture arrangement, add beauty to any home. And they may be installed up to 50% faster because cabinet and coil come preassembled, closures *snap* together. Nonferrous heating element. 8¼" and 12" heights.

More and more air conditioning specifications call for Worthington Induction Systems



- Exceptionally quiet operation
- Small, space-conserving ducts
- Individual room or occupant control
- Draft-free air distribution
- Positive ventilation
- Remote location of all mechanical equipment
- Minimum, centralized maintenance
- Flexibility of partition changing.

WORTHINGTON

CLIMATE ENGINEERS TO INDUSTRY, BUSINESS AND THE HOME

A few of the many modern American buildings for which the new Worthington high pressure induction air conditioning system has been specified.

CHESAPEAKE & POTOMAC TELEPHONE CO., RICHMOND, VA.
Engineer: Baskerville & Son, Richmond, Va.
Architect: Same
Contractor: Wachter & Wolff, Richmond, Va.

N. Y. STOCK EXCHANGE BUILDING (20 BROAD ST.) NEW YORK, N. Y.
Engineer: Jaros, Baum & Bolles, New York, N. Y.
Architect: Kahn & Jacobs & Sidney Goldstone, New York, N. Y.
Contractor: Raisler Corp., New York, N. Y.

UNIVERSITY OF NEBRASKA LINCOLN, NEBRASKA
Engineer: Carl Goth, Omaha, Nebraska
Architect: Hazen & Robinson, Lincoln, Neb.
Contractor: Ray Martin Co., Lincoln, Neb.

LACKLAND AIR FORCE BASE SAN ANTONIO, TEXAS
Architect: Associated Architects, Houston, Texas & York & Sawyer, New York, N. Y.
Contractor: C. Wallace Plumbing Co., Houston, Texas

LIFE & CASUALTY INSURANCE CO. NASHVILLE, TENN.
Engineer: Burns & Thorpe, Memphis, Tenn.
Architect: Edwin A. Keeble Assoc., Inc., Nashville, Tenn.
Contractor: Buchi Plumbing Co., Nashville, Tenn.

MUTUAL BENEFIT INSURANCE CO. NEWARK, N. J.
Engineer: Syska & Hennessy, Inc., New York, N. Y.
Architect: Eggers & Higgins, New York, N. Y.
Contractor: Mance Corp., New York, N. Y.

TRAVELERS INSURANCE CO. HARTFORD, CONN.
Engineer: Jansen & Rogan, New York, N. Y.
Architect: Voorhees, Walker, Smith & Smith, New York, N. Y.
Contractor: Alvord & Swift, New York, N. Y.

LOUISIANA STATE CAPITOL BATON ROUGE, LA.
Engineer: De Laureal & Moses, New Orleans, La.
Architect: Dreyfus, Seiferth & Gibert, New Orleans, La.
Contractor: James F. O'Neil, New Orleans, La.

BANK OF NEW YORK NEW YORK, N. Y.
Engineer: Voorhees, Walker, Smith & Smith, New York, N. Y.
Architect: Same
Contractor: J. L. Murphy, Inc., New York, N. Y.

AMERICAN MUTUAL HARDWARE INSURANCE CO. MINNEAPOLIS, MINN.
Engineer: Thorshov & Cerny, Minneapolis, Minn.
Architect: Same
Contractor: Spencer Air Conditioning Co., Minneapolis, Minn.

QUINCY MUTUAL FIRE INSURANCE CO., QUINCY, MASS.
Engineer: Cram & Ferguson, Boston, Mass.
Architect: Same
Contractor: C. P. Blouin, Boston, Mass.

ILLINOIS POWER CO. DECATUR, ILL.
Engineer: Holabird & Root & Burgee, Chicago, Ill.
Architect: Same
Contractor: R. H. Bishop Co., Champaign, Ill.

Profit by the experience of these architects, engineers, and contractors. Specify Worthington High Pressure Induction Air Conditioning for your next building. Be sure you're getting the very best. For complete details, write: Worthington Corporation, Section A-6, 124, Harrison, New Jersey.

Now available—for you!

VALUABLE NEW BOOK

on Century's

INDUSTRIAL QUALITY...FRACTIONAL H.P. ELECTRIC MOTORS

Right at your desk, make a detailed inspection of Century's Fractional H.P. single phase and polyphase line of motors, designed to latest NEMA standards! This fact-filled new book gives you the comprehensive story on Century's *new* 48-Frame and 56-Frame INDUSTRIAL QUALITY Motors...tells how and why they're *better performers* than the older models, why they weigh less, take less space, are easier to handle.

Motor types and mountings are described, stator and rotor construction, how to select proper torque and speed...and many other facts to help you choose the right motors for *top performance*...all along the line!

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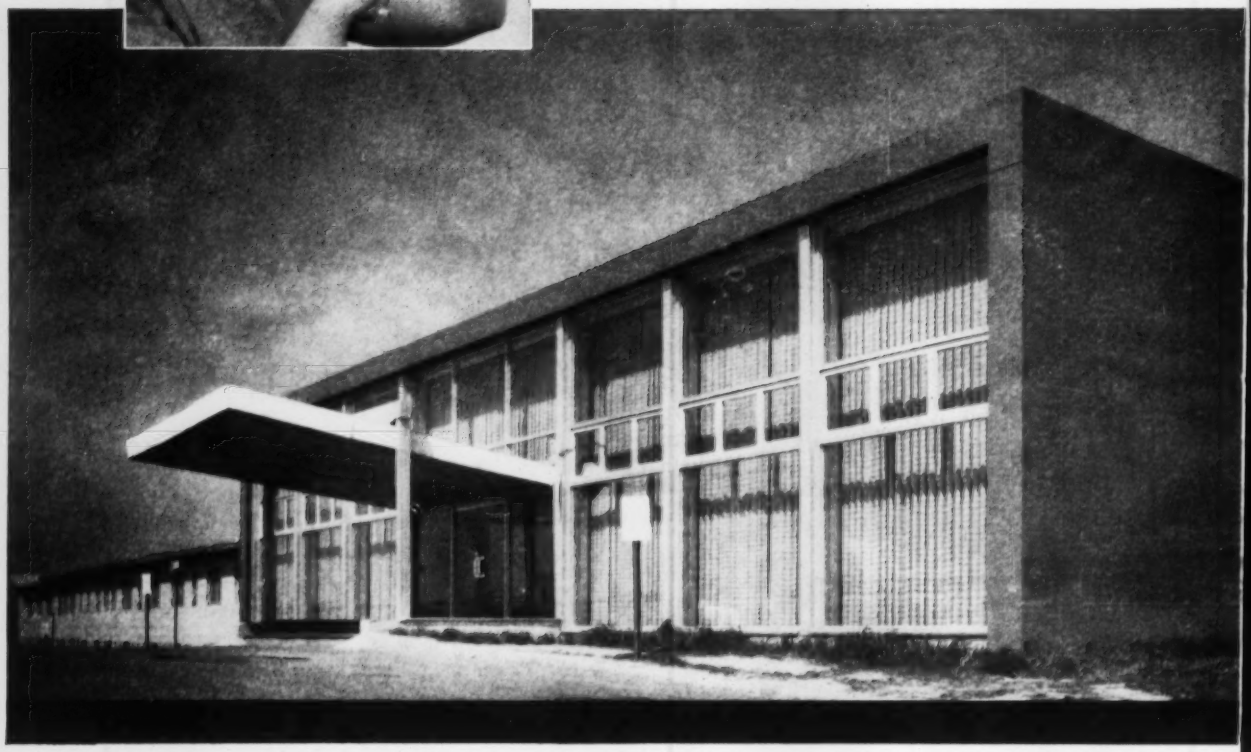
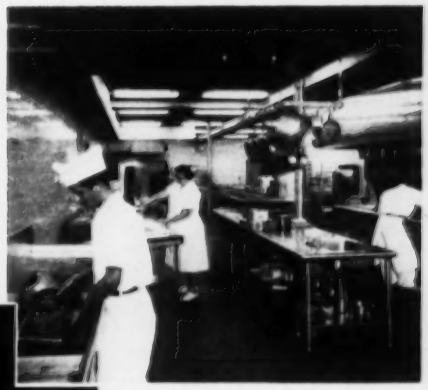
KEWANEE "*CRUISING* PASSES CRITICAL



■ In a hospital there can't be the slightest margin of error. Nowhere else is equipment required to pass such critical tests. Mr. Howard A. Palestine, Manager of Mid-Island Hospital, Bethpage, Long Island, puts it this way: "Like all hospitals, ours operates 24 hours a day, 7 days a week . . . and we do it with the help of such dependable equipment as Kewanee Boilers. It was the reputation which KEWANEE has built up over the years which prompted us to specify that this type of boiler system be used." Rated on nominal capacity, Kewanee Reserve Plus Rated Boilers with 50% extra built-in power, fill normal requirements in stride. Yet, they can be stepped up instantly to produce additional power needed for emergencies—for fluctuating loads. They provide for expansion too. Here you get "cruising speed" boiler operation with greater efficiency—lower fuel and maintenance costs . . . less stress and strain, plus constant protection against breakdowns and repairs. There's no necessity to operate at full speed all the time. In addition, "cruising speed" operation means you get much longer boiler life. So select Kewanee Reserve Plus Rated Boilers. You can be sure of dependable service, with savings in money too. KEWANEE BOILER DIVISION OF AMERICAN-STANDARD, 101 Franklin Street, Kewanee, Illinois.

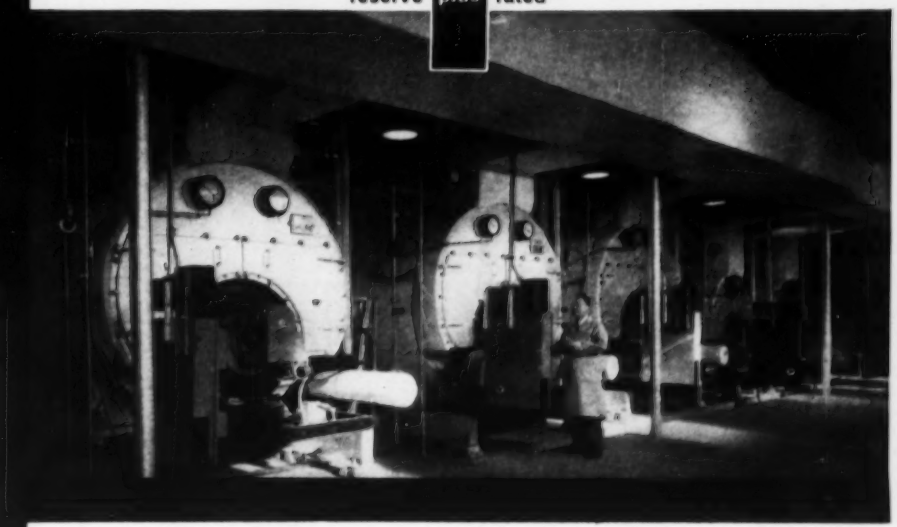
SPEED" BOILER OPERATION TEST AT MID-ISLAND HOSPITAL

Reception room and admitting desk of Mid-Island Hospital.



The spotless kitchen where appetizing meals are prepared.

KEWANEE
reserve plus rated



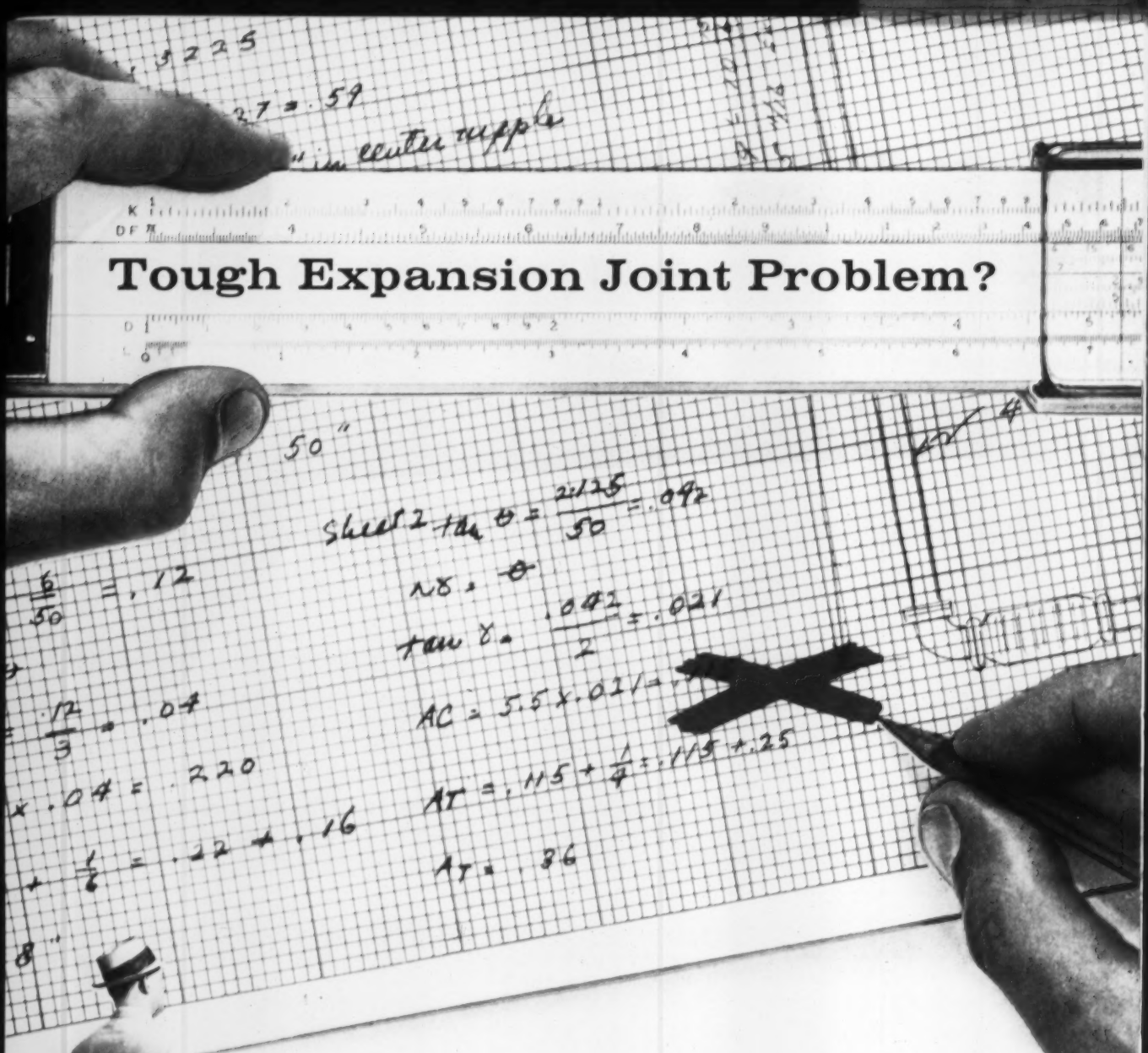
Here are five Kewanee Boiler-Burner Units which provide 'round the clock dependable service at Mid-Island Hospital.

Mid-Island Hospital, Bethpage, Long Island, New York. Designed, engineered and constructed by Will N. Clurman Associates, New York, N.Y.

Architects: Gloster & Gloster, Rockville Center, New York.

AMERICAN-Standard

KEWANEE BOILER DIVISION



Tough Expansion Joint Problem?

Put the Badger Man on the Spot!

Complex expansion joint problems are *best* analyzed at only one place: your office or plant site. It's there alone — where the figuring is going on — that *all* essential data about your proposed installation is available.

And it's there — *on the spot* — that the Badger Man can assist you. Because 1. he is a trained engineer; 2. he brings to your problem the background of the world's most experienced manufacturer of expansion joints.*

Next time you are confronted with a complicated piping layout, severe operating conditions, unusual size and shape requirements — *any* complex expansion joint problem — put the Badger Man on the spot! His services are as close as your telephone.

COMING SOON — Badger Service-Rated Expansion Joints. Incorporate revolutionary new features developed during three years of intensive research and testing. Watch for this important announcement.

* Badger has been solving tough expansion joint problems for 50 years — a record unmatched by any other firm.

BMC

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BADGER MANUFACTURING COMPANY

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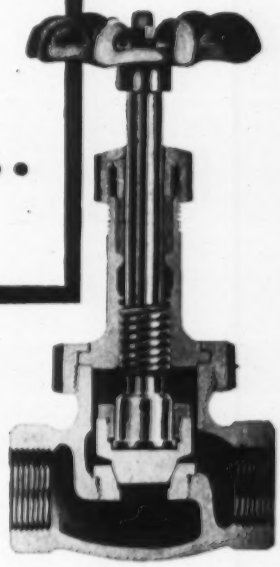
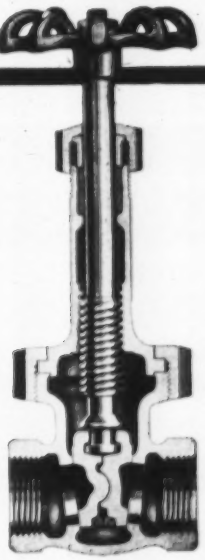
Representatives in principal cities

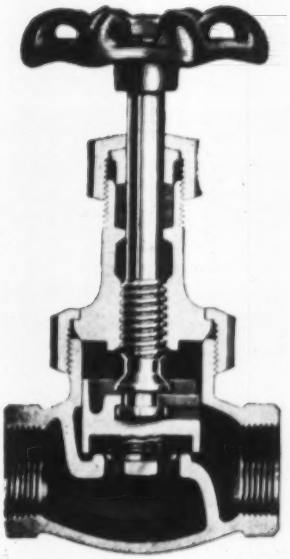
Walworth bronze valves...



Walworth No. 225P Globe Valve
500 Brinell Seat and Disc



Walworth
No. 29 Gate Valve



Walworth No. 95 Globe Valve
Re-New-Disc

built to give dependable trouble-free service on all recommended jobs

Walworth No. 95 Bronze Globe Valves (Angle Type: No. 96) are recommended for service where throttling is not required. They are rated at 150 psi working steam pressure, 500F; 300 psi cold water, oil or gas. The improved renewable disc and lock-on, slip-off disc holder — an original Walworth development—saves time and trouble. This valve can be repacked under pressure when fully opened. All parts are designed to give maximum service and strength.

Walworth No. 29 Bronze Gate Valves are rated at 200 psi working steam pressure, 550F; 400 psi cold water, oil and gas. These valves have rising stems and integral seats. Sizes 2-inch and smaller have union bonnets; sizes 2½ and 3-inch have bolted bonnets. Valves up to and including ¾-inch have solid wedge discs; 1-inch and larger have split wedge discs. These valves can be repacked under pressure when fully opened.

Walworth No. 225P Bronze Globe Valves (Angle Type: No. 227P) are rated at 350 psi working steam pressure, 550F; and 1000 psi non-shock service on cold water, oil and gas. The stainless steel, plug type seat and disc — heat treated to 500 Brinell — can be closed on sand, slag, scale and similar floatage, without injury to the seating surfaces. They are the longest wearing, TOUGHEST bronze valves you can buy.

For full information about Walworth Quality Bronze Valves, see your Walworth distributor, or write:

GLOBE

GATE

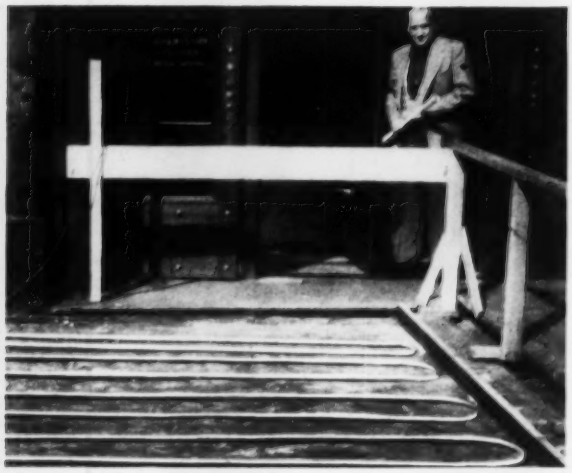
ANGLE

WALWORTH
valves and fittings

60 EAST 48nd STREET NEW YORK 17, N. Y.

CHECK

Leak-free joints made easily with torch and solder.



Section of system ready for paving.

Milwaukee Gas Light Company

MAKES SNOW GO

with Chase Copper Water Tube!

Blizzard snows and freezing rain don't stand a chance around 626 East Wisconsin, in Milwaukee! The Milwaukee Gas Light Company's sidewalks are always free of snow and ice—thanks to an efficient snow removal system of Chase copper tube!

The contractor, John S. Jung, used both Chase Type L copper tube and Chase copper solder-joint fittings in the installation. This combination is unsurpassed for easy, fast installation plus trouble-free performance over the years! You see, corrosion-resistant Chase copper tube comes in long lengths that are easily bent into position and require fewer joints. Tube and fittings are *made for each other*, so leakproof solder-joints are assured. They expand and contract *as one unit* with temperature changes!

Snow everywhere . . . but not around Milwaukee Gas Light Co. building.

Chase

BRASS & COPPER CO.

WATERBURY 20, CONNECTICUT • SUBSIDIARY OF KENNECOTT COPPER CORPORATION

The Nation's Headquarters for Brass, Copper & Stainless Steel

Atlanta	Chicago	Denver	Indianapolis	Minneapolis	Philadelphia
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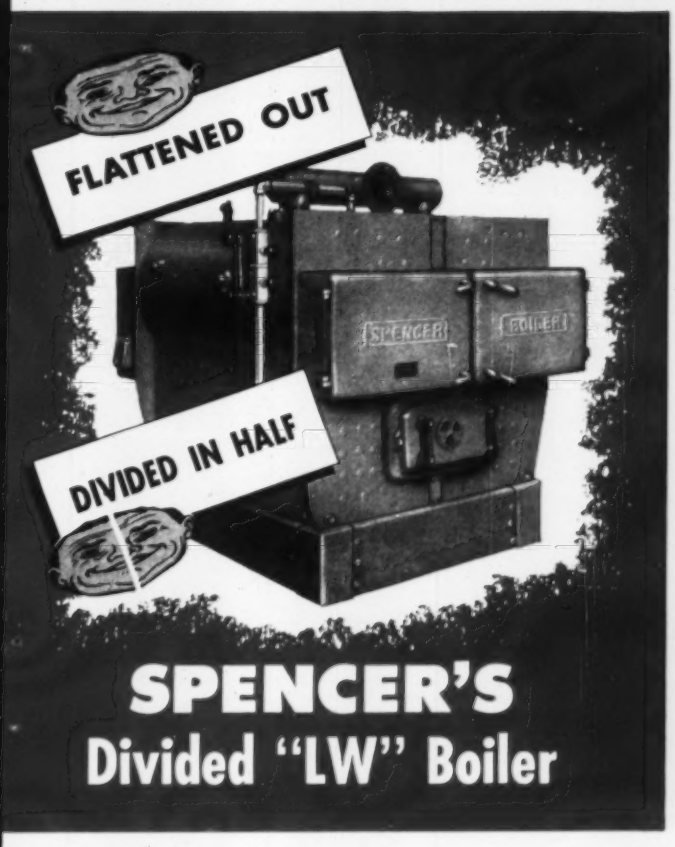
Boston	Cleveland	Grand Rapids	Los Angeles	New Orleans	Providence
Charlotte	Dallas	Houston	Milwaukee	New York	Rochester
	St. Louis	San Francisco	Seattle	Waterbury	

SOLVE major heating problems with advanced SPENCER designs!



SPENCER'S Divided "LW" Boiler

Unique Low-Waterline "LW" solves installation problems

Divided in half . . . can be moved, one watertight section at a time, through narrow openings.

25% lower than conventional boilers of same capacity. Solves low headroom problems in existing buildings . . . excavation problems in new buildings. Traditional Spencer efficiency can be adapted to any fuel . . . mechanical or hand firing.

SIZES:
ranging from 3,500 to 42,500 sq. ft. steam

SPENCER'S "A" Boiler

Durable Spencer "A" cuts installation time... provides economical heat

Unique flue-and-smoking units save hours in installation time; compact design saves valuable floor space—takes less headroom. Special peaked firebox and staggered boiler tubes provide faster heating . . . more efficient heat transfer; available for stoker or hand firing . . . can be adapted to any fuel.

SIZES:
ranging from 3,500 to 42,500 sq. ft. steam

SPENCER
HEATER
LYCOMING DIVISION
WILLIAMSPORT LYCO PENNSYLVANIA

H SBI

A New Approach to Perfection

MAINTENANCE-FREE LIMA MOTORS

IN ALL NEW NEMA FRAME SIZES

- 30% LESS WEIGHT PER HORSEPOWER
- 30% VOLUMETRIC SIZE REDUCTION
- DUAL FANS INTEGRALLY CAST WITH ROTOR
- COMPLETE ROTOR ASSEMBLIES DYNAMICALLY BALANCED
- RIGID, CAST IRON FRAMES WITH INTEGRALLY CAST FEET
- DIAGONALLY SPLIT CAST ALUMINUM CONNECTION BOXES—CADMIUM PLATED COVER SCREWS
- TOTALLY ENCLOSED FRAMES MEET A.I.E.E. SPECIFICATIONS

Slash maintenance costs and eliminate costly inspection and lubrication programs with Lima Motors in NEW NEMA frame sizes. With lubricated-for-life DOUBLE-WIDTH ball bearings, solid die cast aluminum rotors with dual integral fans, and Mylar insulation . . . Lima gives you higher full-load speeds with the most complete motor protection available. Install these new Finest Quality Lima Motors—and forget them.

Lima now has in production all ratings in new NEMA frame sizes 182 through 326U. Get complete details on Lima's new NEMA *maintenance-free* motors from your Lima Representative now! If he is not already calling on you, his name and address will be found in *Thomas' Register, MacRae's Blue Book* or *Conover-Mast Purchasing Directory*.

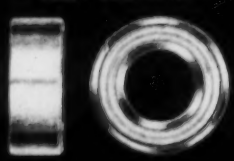
Of course, Lima will continue to produce regular NEMA frame sizes 66 to 505 (⅓ to 150 H.P.), incorporating the latest advances in motor design.

SINGLE-WIDTH
UNPROTECTED

THE OLD WAY

Open and unprotected motor bearings subject to contamination and must be inspected and lubricated frequently.

DOUBLE-WIDTH
FULLY PROTECTED



THE LIMA WAY

Sealed and protected—Lima's DOUBLE-WIDTH *pre-lubricated* motor bearings require no attention—just put the motor to work and forget it.

THE LIMA ELECTRIC MOTOR COMPANY, 4901 Hanley Road Lima, Ohio

LIMA

FIRST . . . FOR MOTORS . . . DRIVES . . . SPEED REDUCERS

in the air moving and conditioning field—

AMCA* HELPS *YOU* DO YOUR JOB *BETTER!*

If you are an architect, consulting engineer, building contractor, or plant engineer—if you are in any way concerned with the design, installation, or maintenance of air moving and conditioning systems—AMCA is now helping you to do your job better.

* *what is AMCA?*

AMCA, the Air Moving and Conditioning Association, Inc., is a non-profit trade association formed this year, in the service of industry and the public, by the merger of three predecessor organizations.

* *who comprises AMCA?*

Fifty-one leading manufacturers of air moving and conditioning equipment have joined to form AMCA. Member companies manufacture products falling within one or more of the Association's major product divisions: Centrifugal Fans; Industrial Axial and Propeller Fans; Central Station Air Conditioning units; Power Roof Ventilators; Unit Heaters; and Residential Fans.

* *how AMCA benefits you*

The activities of AMCA benefit you in many ways, both directly and indirectly. Here are a few:

1. AMCA compiles and makes available to you technical information relating to air movement, heating and cooling.
2. To protect you, AMCA establishes and promotes the use of standards for equipment performance and testing methods.
3. AMCA conducts exploratory research on basic industry problems to improve the products and methods you will use.
4. AMCA functions as a clearing house for all industry activities and stimulates the exchange and dissemination of ideas.
5. AMCA maintains close liaison with public agencies, serving as spokesman on matters regarding the industry.

AIR MOVING & CONDITIONING ASSOCIATION, INC.

2159 GUARDIAN BUILDING **DETROIT 26, MICHIGAN**

MEMBER COMPANIES

Acme Equipment Company
Aerovent Fan Company, Inc.
Air Controls, Inc. Division, Cleveland Heater Company
Airtherm Manufacturing Company
Aladdin Heating Corporation
Allen Cooler & Ventilator, Inc.
American Air Filter Co., Inc.
American Blower Corporation
American Coolair Corporation
American Steel Band Company
Bar-Brook Manufacturing Co., Inc.
Bayley Blower Company
The Bishop & Babcock Manufacturing Co., Massachusetts Blower Division
Buffalo Forge Company
Burt Manufacturing Company
Carnes Corporation
Carrier Corporation
Century Fan & Ventilator Company
Chelsea Fan & Blower Company, Division Chelsea Products, Inc.
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De Bothezat Fans Division, American Machine & Metals, Inc.
Fedders-Quigan Corporation
The Gallaher Company
Garden City Fan Company
General Blower Company
The Green Fuel Economizer Co., Inc.
Grinnell Company, Inc.
Hartzell Propeller Fan Company, Division Castle Hills Corporation
Hirschman-Pohle Company
Hunter Fan & Ventilating Co., Inc.
Ilg Electric Ventilating Company
International Engineering, Inc.
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McCord Corporation
Modine Manufacturing Company
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The New York Blower Company
Peerless Electric Company
Penn Ventilator Company
Propellair Division, Robbins & Myers, Inc.
Reed Unit-Fans, Inc.
The Swartwout Company
The Trane Company
Utility Fan Corporation
Viking Air Products Division, National U. S. Radiator Corporation
Westinghouse Electric Corporation, Sturtevant Division
L. J. Wing Manufacturing Co.
Young Radiator Company

Aluminum Ideas — BUY the dozen

1

EXTRUDED ALUMINUM TUBE

Wolverine extruded aluminum tube is available in a wide range of sizes in popular alloys. Like all Wolverine products it is rigidly quality controlled.

2

DRAWN ALUMINUM TUBE

At Wolverine, batteries of draw benches—manned by operators skilled in Tubemanship—produce drawn aluminum tube in popular alloys in a wide range of sizes.

3

ALUMINUM TUBE IN COILS

Wolverine aluminum tube is also available in medium and extra long coils—ideal for reducing handling and storage space.

4

WOLVERINE TRUFIN® TYPE S/T

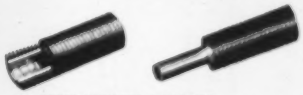
Available in lightweight aluminum, integrally finned Trufin Type S/T is designed especially to boost performance of shell and tube heat exchangers and condensers.

5

WOLVERINE TRUFIN TYPE I/L

An all aluminum tube, Type I/L has helical fins on its exterior surface and longitudinal fins on the inside. It is designed especially for air-cooled heat transfer operations.

6



WOLVERINE TRUFIN TYPES H/A AND H/R

These high finned condenser tubes are also designed for air-cooled heat transfer operations. They are available with various fin spacings in a wide range of sizes.

7

WOLVERINE DUPLEX CONDENSER TUBE

Designed to offset simultaneous corrosive attack on two sides; this type of condenser tube can have an inner—or outer tube of lightweight aluminum mechanically bonded to another tube of any desired alloy.

8

EXTRUDED SHAPES

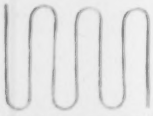
Wolverine extrudes aluminum shapes to customer specifications. Rigidly quality controlled, these extrusions help manufacturers reduce machining and assembly operations, save on material requirements.

9

EVAPORATOR SUB-ASSEMBLY

Prefabricated evaporator sub-assemblies are real time, equipment and labor savers. They are composed of a bunch-type aluminum coil, a one-piece aluminum accumulator and two aluminum-to-copper connectors.

10



SERPENTINE COIL

Wolverine aluminum serpentine coils permit manufacturers to place a maximum length of tube in a small area. Wolverine is also equipped to coil, flare, expand, etc.

11

ALUMINUM-TO-COPPER CONNECTORS

Available in ⅛" and 3/16" tube diameters, handy connectors permit manufacturers to use both copper and aluminum tube in the same refrigeration cycle.

12

SPUN END PARTS

With its Aluminum Spun End Process†† Wolverine produces a wide variety of tubular-shaped parts with fully or partially closed end treatments in one, economical operation.

††PROCESS PATENT APPLIED FOR

FOR MORE INFORMATION JUST CHECK THE NUMBER ON THIS COUPON AND *MAIL*

1 2 3 4 5 6 7 8 9 10 11 12

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DIVISIONS OF CALUMET & HECLA, INC.

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GOODMAN LUMBER CO.

WOLVERINE TUBE

Division of Calumet & Hecla, Inc.
1461 CENTRAL AVENUE, DETROIT 9, MICHIGAN.

Manufacturers of Quality Controlled Tubing and Extruded Aluminum Shapes

PLANTS IN DETROIT, MICHIGAN, AND DECATUR, ALABAMA.
SALES OFFICES IN PRINCIPAL CITIES.
EXPORT DEPT., 13 E. 40TH ST., NEW YORK 16, N.Y.

Wolverine Trufin is available in Canada through the Unifin Tube Company, London, Ontario.

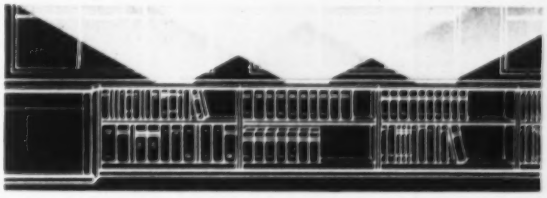
Norman Schoolroom Heating and Ventilating System

a gas-fired, forced air package . . .

Never before has a forced air system offered so many features for low cost classroom heating, ventilating and filtering — using both outside air and recirculated room air.

The Norman Schoolroom Package has important advantages for economical installation and operation. It automatically does the complete job of maintaining healthful and efficient comfort throughout the classroom — using ducts and perimeter diffusers in attractive Util-i-Duct bookshelf sections.

Because each classroom has its own automatic heating and electrically controlled ventilating system, no separate building or additional space to house a central heating plant is necessary. Inter-connecting supply and return mains are eliminated. And any number of additional classrooms can be added in the future without costly revamping of the heating system.



Diffusers in Util-i-Duct sections spread a blanket of controlled tempered air upward and outward at correct angles for proper air distribution without drafts.

Norman® products company

Mail the coupon today for full details and specifications

NORMAN PRODUCTS CO.
1156 Chesapeake Ave., Columbus 12, Ohio

Please send me complete information on the Norman gas-fired, forced air Schoolroom Heating and Ventilating System.

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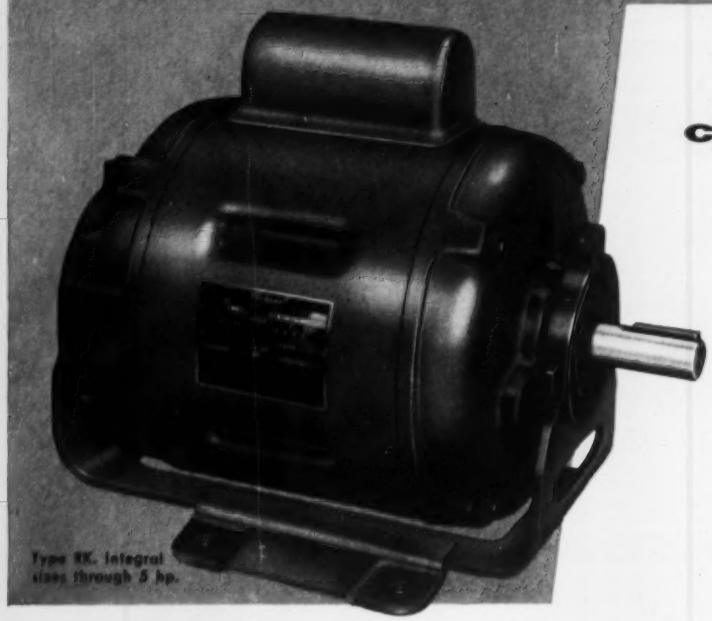
CITY _____ STATE _____

WAGNER ELECTRIC MOTORS...THE CHOICE OF LEADERS IN INDUSTRY



Type RK, Integral sizes through 5 hp.

choose these smaller, lighter, motors... for modern equipment

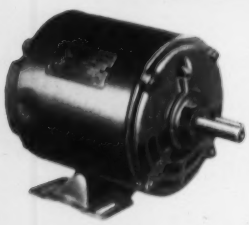
For years Wagner motors have been the first choice of many leading manufacturers of air conditioners, refrigerators, freezers, water pumps and motor-driven tools. They meet the requirements of many other similar applications because of their high starting torque and low starting current.

Now these Wagner motors are lighter in weight and smaller in size. This means that you can design smaller motor housings—build lighter motor mountings. Wagner motors are easier to handle and easier to stock because they take up less space.

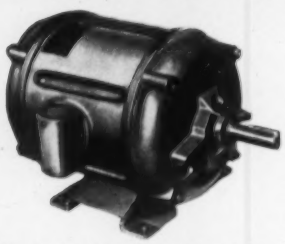
And these motors offer low maintenance costs—only a minimum of servicing is required—they give many years of reliable service with unusual freedom from vibration and noise.

Available in repulsion-start or capacitor-start types—open or totally-enclosed—sleeve or ball bearing—with rigid or resilient bases or machined endplates for flange mounting. Write today for Bulletin MU-185 which gives complete information.

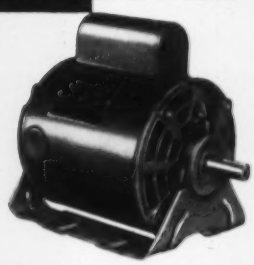
A Complete Line—Single-phase and Polyphase Motors



Type RP, Polyphase fractional horsepower motors. Available in ⅛, ¼, ⅓, ½, and ¾ hp ratings. Rigid or resilient base—sleeve or ball bearing.



Type RA, Repulsion-start induction-run single-phase motors. For applications requiring high starting torque. ½ to 15 hp.



Type RK Capacitor-start, ⅓, ½, and ¾ hp . . . sleeve or ball bearings. The resilient mounting offers unusual freedom from vibration and noise.

Wagner Electric Corporation
EST. 1891

Wagner Electric Corporation
6370 Plymouth Ave., St. Louis 14, Mo., U.S.A.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS-AIR AND HYDRAULIC

M56-3

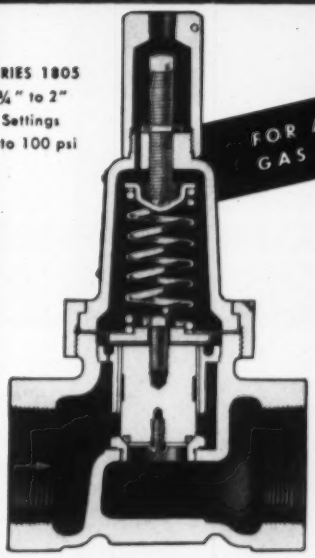
look to FISHER

for genuine relief from overpressure worries!

Hundreds of plants have found Fisher compact and self-contained relief valves the answer to their relief or back pressure control problems. Whether it may be a rather unusual problem, or simply to protect your gas system for safety reasons, or possibly to relieve excess pressure from a pump, by-passing back to suction, the chances are Fisher could solve your problem. May we suggest you contact our representative in your area?

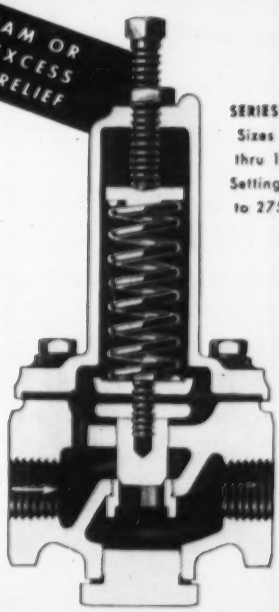
SERIES 1805
¾" to 2"
Settings
5 to 100 psi

FOR AIR OR GAS RELIEF



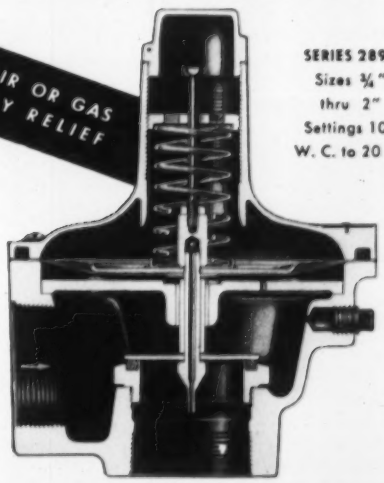
FOR STEAM OR LIQUID EXCESS PRESSURE RELIEF

SERIES 372
Sizes ½"
thru 1½"
Settings 10
to 275 psi



FOR AIR OR GAS SAFETY RELIEF

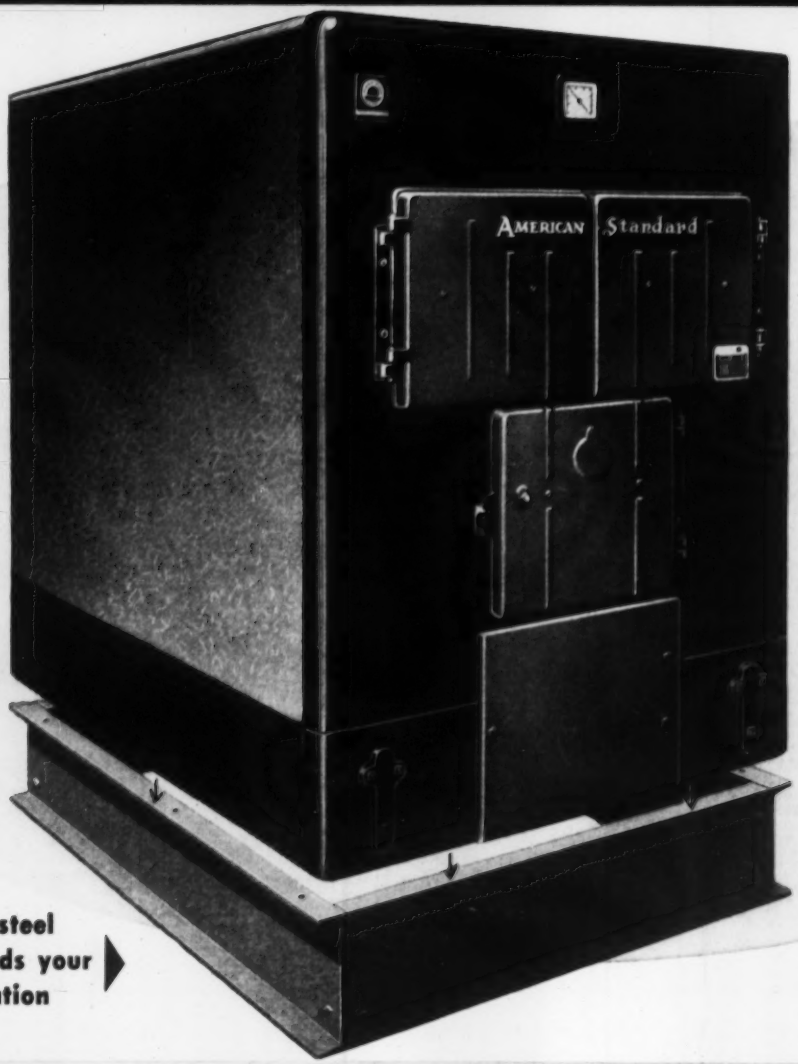
SERIES 289H
Sizes ¾"
thru 2"
Settings 10"
W. C. to 20 psi



FISHER GOVERNOR COMPANY
MARSHALLTOWN, IOWA • WOODSTOCK, ONTARIO
LEADS THE INDUSTRY IN RESEARCH FOR BETTER PRESSURE AND LIQUID LEVEL CONTROL

FISHER
Since 1880

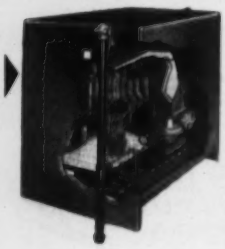
Install- The new, A-7 Cast Iron Boiler



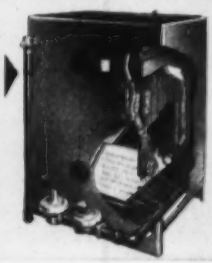
Exclusive, new steel pedestal base speeds your heating installation

CAST TO LAST—CAST IRON BOILERS BY AMERICAN-Standard

G-4 gas-fired boiler—4 to 12 sections—only 47½" high—factory-assembled manifold permits fast, easy installation.



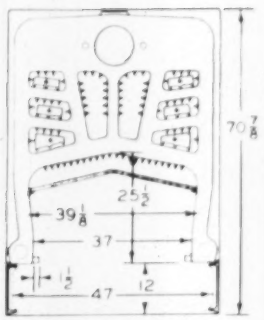
G-6 gas-fired boiler—for large buildings—cast iron base permits fast, low-cost installation—durable cast iron sections assure service—all major components under jacket enclosure.



Oakmont oil-fired heating unit—commercial and residential application—sturdy cast iron sections—Heat Lib-O-Rator, factory-moulded refractory combustion chamber—Arcoflame oil burner.

compact AMERICAN-Standard ...for all fuels

Exclusive STEEL PEDESTAL BASE ELIMINATES FLOOR PIT AND FIRE-BRICK BASE—BOLTS TOGETHER QUICKLY AND EASILY — CUTS YOUR INSTALLATION TIME AND COST



Added exclusive feature—upward and outward design of waterways, plus high water level, assures proper and continuous water flow; prevents lag in waterways, assures quick, smooth steaming.

PLUS—*these important features:*

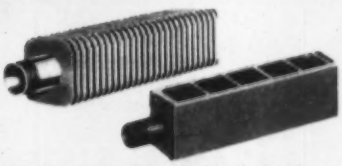
- Sections of rugged, heavy-duty cast iron – factory-tested at 2½ times normal operating pressure.
- Eight practical sizes – 5 to 12 cast iron sections.
- Performance range of 2,630 to 6,380 sq. ft. net steam rating – 4,345 to 10,205 sq. ft. net water rating.
- Output from 869 Mbh to 1,972 Mbh.
- Compact, lightweight design facilitates handling.
- Designed for external-type domestic water heater.
- Special fin arrangement on sections provides maximum heating surface.

See your local American-Standard distributor today —or write for more information on the A-7 and other American-Standard heating products to AMERICAN-STANDARD, PLUMBING & HEATING DIVISION, 40 West 40th Street, New York 18, N. Y.

AMERICAN-Standard

PLUMBING AND HEATING DIVISION

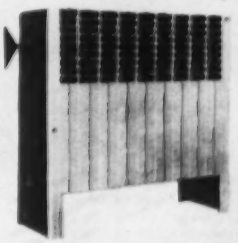
AMERICAN-Standard radiation means simple installation at low cost



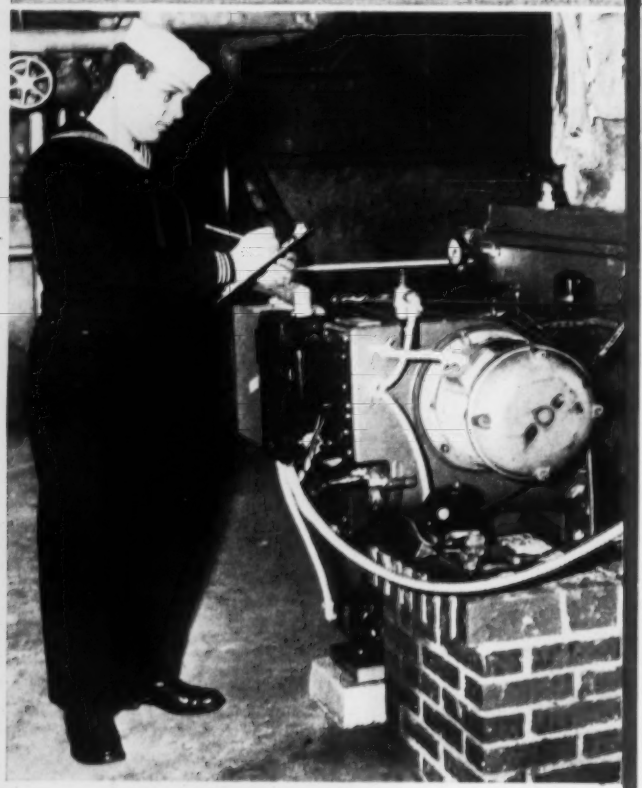
Temtrim finned tube radiation—for maximum economy . . . install exposed or choice of three smart covers (flat-top cover pictured).

Multifin Convector—quality-built non-ferrous convector—stock and special service models for all heating requirements.

Sunrad Radiator—cast iron radiator—recessed or free standing installation saves space—gives high output. Two convenient depths and heights—5" and 7½" deep, 20" and 23" high.



The Training Center was named for Commodore William Bainbridge, commander of the famous frigate CONSTITUTION, immortalized in the poem "Old Ironsides."



U. S. NAVY estimates savings of $641,000* annually with 194 Cleaver-Brooks HEV-E-OIL Burners

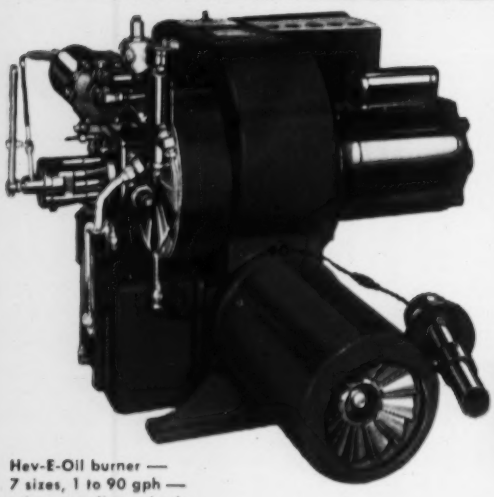
THE U.S. NAVAL TRAINING CENTER, Bainbridge, Md., trains 50,000 men and graduates 6,000 men a year in advanced technical skills needed for defense. The men are kept comfortably warm by 194 Hev-E-Oil burners, famous for outstanding efficiency, fuel economy and precision construction. The Hev-E-Oil burner uses low-cost No. 5 oil — an oil rich in heat energy, but lower in cost than lighter No. 2 oil. Estimated savings to the Navy amount to $641,000 annually.

In hundreds of other installations all over the world, efficient Hev-E-Oil burners are cutting fuel costs . . . achieving savings that amount to thousands of dollars annually for schools, office buildings, hospitals, apartments and stores.

You, too, will like the quality construction and sound basic design of the Hev-E-Oil burner. It offers full flame modulation, automatic pressure lubrication, low fire start with no puff backs, and accurately metered oil and air for the best in economical performance. Little wonder the Hev-E-Oil burner has proved itself a leader in performance and in sales.

If you own, specify, install or service burners, get all the facts about the burner designed to save you money. Write for illustrated bulletin AD-102 now. Cleaver-Brooks Company, Dept. M, 392 E. Keefe Ave., Milwaukee 12, Wis.

*Official U.S. Navy Records



Hev-E-Oil burner — 7 sizes, 1 to 90 gph — adapts to all standard heating boilers

For a career with a future see your Navy recruiter

Bainbridge Burners sold by Hev-E-Oil Burner Distributors, New York City

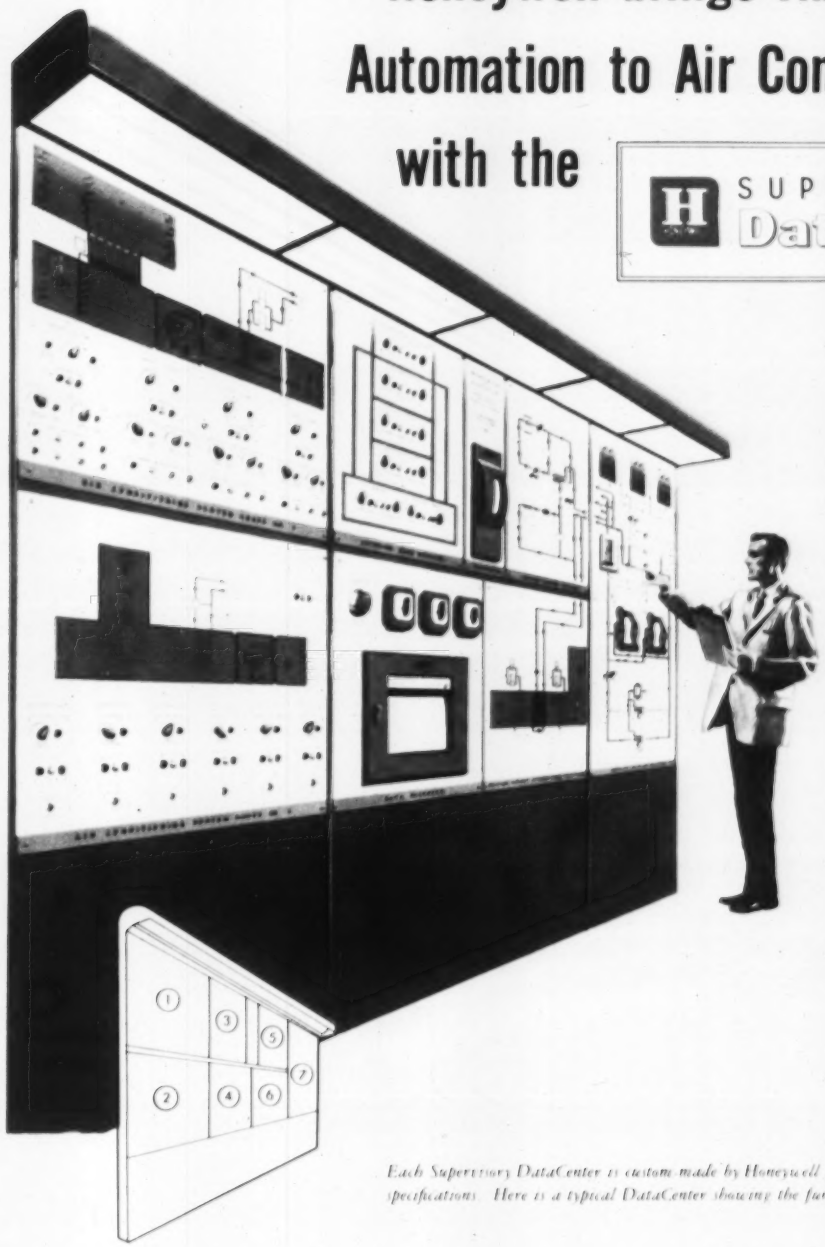
Cleaver Brooks 25th YEAR

Hev-E-Oil burner will cut your fuel costs

a bold new concept . . .

Honeywell brings Advanced Automation to Air Conditioning with the

SUPERVISORY DataCenter



Each Supervisory DataCenter is custom-made by Honeywell to engineers' and architects' specifications. Here is a typical DataCenter showing the functions of the various panels.

(1) **Typical Central Supply Unit.** Provides remote adjustment of mixed air and coil deck temperatures, plus coil air temperature readings. Final space temperature is determined by local pneumatic thermostats that regulate the percentage of air passing through the coil deck bypass for each zone. (These temperature readings—as well as those concerned with other panel functions in the complete system—are shown by the indicator located on the vertical top center panel.)

(2) **Typical Annex Unit.** These units control space temperatures in other areas of the building. Temperature corrections are made by means of the control point adjustment knobs located beneath the graphic outline of the building.

(3) **Interior Space Temperatures.** Outline provides graphic floor-by-floor picture of the interior space thermostats. Push-button control and adjustment may be made from the panel.

(4) **6-Point Temperature Recorder.** To permit careful analysis of operations, this instrument gives a simultaneous record of any 6 temperature pickups in the entire system.

(5) **Basic Heating and Cooling Circuit.** Start-stop buttons control circulating pumps; pilot lights indicate which equipment is operating. Panel also provides several push-button temperature readings with adjustment of controlling thermostats.

(6) **Primary Air System.** This section provides push-button temperature readings, and adjustment of thermostats controlling reheat and dehumidifier coils.

(7) **Basic Refrigeration Plant Supervision.** Shown here is color diagram of the system with miniature controller for remote indication and adjustment of chilled water temperature. Accessory equipment can be started and stopped at the panel—pilot lights indicate when they're running. Push buttons provide temperature readings at all key points in this system.

One man operation of a complete year-round climate control system saves thousands of dollars for building owners

Focuses all eyes on air conditioning. Publicly displayed, a colorful Honeywell Supervisory DataCenter does a lot to highlight a building's "hidden" deluxe comfort features.

ADVANCED automation in air conditioning, made possible by the Honeywell Supervisory DataCenter, has resulted in many remarkable achievements in practically every phase of indoor climate control.

New techniques of automation, instrumentation and electronics make air conditioning as automatic as possible and provide for efficient supervision.

Operating efficiencies have been realized that were never believed possible. To the public it has brought a new standard of comfort. And to the engineer and architect it offers the opportunity to dramatize the use of air conditioning and provide flexibility of design that will avoid obsolescence for years to come.

And remember, every component in a Honeywell Supervisory DataCenter is made by Honeywell, backed by Honeywell's dependable service.

Central control of every floor. Temperature in open areas on every floor, plus functions in the complete system are always under finger-tip control at one central point.

Better individual room thermostat control. A DataCenter improves space thermostat performance by permitting closer supervision of the primary heating and cooling supply.

DataCenter does the "leg work". Readings from any remote point in the building come to one central control panel—eliminating the need for laborious, manual floor-by-floor checking.

Savings liquidate equipment cost. A DataCenter combines a number of operating-maintenance jobs into *one*—also detects operating irregularities to make trouble shooting easier, faster.

For skyscraper, super market—for any size building, because each supervisory DataCenter is custom-made with the controls and instrumentation to fit a specific air conditioning system.

SUPERVISORY DataCenter

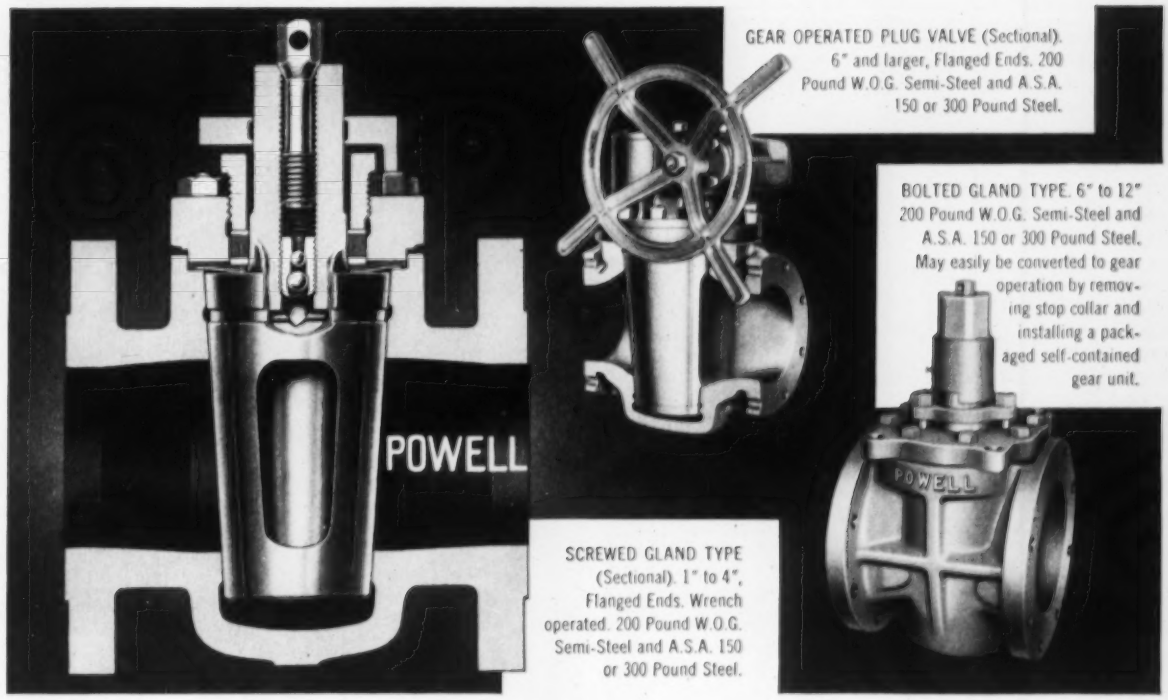
For further information about the Supervisory DataCenter, call your Honeywell office, or write: Honeywell, Dept. SDC-3, Minneapolis 8, Minnesota.

A product of MINNEAPOLIS **Honeywell**

First in Controls

POWELL

Lubricated Plug VALVES



GEAR OPERATED PLUG VALVE (Sectional). 6" and larger, Flanged Ends. 200 Pound W.O.G. Semi-Steel and A.S.A. 150 or 300 Pound Steel.

BOLTED GLAND TYPE. 6" to 12" 200 Pound W.O.G. Semi-Steel and A.S.A. 150 or 300 Pound Steel. May easily be converted to gear operation by removing stop collar and installing a packaged self-contained gear unit.

SCREWED GLAND TYPE (Sectional). 1" to 4", Flanged Ends. Wrench operated. 200 Pound W.O.G. Semi-Steel and A.S.A. 150 or 300 Pound Steel.

Powell Lubricated Plug Valves maintain our 110-year tradition of quality and precision. Only the finest available materials are used. And painstaking quality control is rigidly enforced through each and every step of manufacture.

Features include quick and positive operation—just a quarter-turn to open or close. Lubricant grooves surrounding each port provide a positive seal when the valve is closed. In an open position, seating surfaces are not exposed.

Valve users who want one source of supply for lubricated plug as well as all types of bronze, iron, steel and corrosion-resistant valves will want full details on Powell Lubricated Plug Valves.

Available in Steel and Semi-Steel through distributors in principal cities. If none is located near you—or if you need help on valve problems—write direct to

PERFORMANCE PV VERIFIED

BRONZE, IRON, STEEL AND CORROSION-RESISTANT VALVES

The Wm. Powell Company, Cincinnati 22, Ohio . . . 110th YEAR

The source of supply for all valve needs!

AIRCOUSTAT* sound traps layout for controlling

AIRCOUSTAT SILENCES ALL FREQUENCIES IN THE AUDIO-FREQUENCY RANGE
Resonators hold low-frequency sounds
Periodic internal structure dampens middle-frequency noise
Sound-absorbent materials suppress high frequencies

simplify design and air conditioning noise

THIS 5-FT. AIRCOUSTAT REPLACES 80 FEET OF ORDINARY DUCT LINING

AIRCOUSTAT saves you time on the job because it's pre-engineered . . . and fits acoustically if it fits geometrically. AIRCOUSTAT is quick and easy to install . . . no special tools are required.

Most Efficient Solution

AIRCOUSTAT's power to deaden sound is unmatched by other sound control methods devised for air conditioning systems. Acoustical performance is *guaranteed*. Efficiency is more than 13 times that of ordinary lining. And AIRCOUSTAT provides a lower flow resistance and less pressure drop than other sound control methods.

AIRCOUSTAT suppresses sound in low-velocity air conditioning systems . . . will silence an entire system or selected outlets. AIRCOUSTAT units fit any size of duct within the range of unit sizes . . . adapt themselves to any shape of duct.

Cost You 50% Less

AIRCOUSTAT units cost you as much as 50% less than ordinary duct lining . . . with savings in time and labor costs. AIRCOUSTAT is quick and easy to install . . . no special tools are required. You can ship ducts nested together and store them outside on the job site.

Apply Anywhere

AIRCOUSTAT eliminates noise in a wide range of applications: general and private offices, conference rooms, sleeping quarters, and recording studios.

Born of the Jet Age

Koppers' amazing new AIRCOUSTAT is the product of years of experience in designing sound control installations for aviation and other industries. Jet engine housings, machine enclosures, sound barriers and traps, sound-proof foremen's offices—these are only a few of the many sound control devices created by Koppers Industrial Sound Control engineers. Koppers has put this engineering "know-how" to work silencing air conditioning noises more effectively . . . more economically than was ever before possible . . . saving you time and costs.

For more details, write to KOPPERS COMPANY, INC., Industrial Sound Control Dept., 6211 Scott Street, Baltimore 3, Maryland.

*Koppers Trademark

KOPPERS

INDUSTRIAL SOUND CONTROL

Engineered Products Sold with *Service*

From left: American Blower representative H. B. Prewitt; Consulting Engineers C. S. Leopold and F. H. Buzzard of Charles S. Leopold, Engineers; J. G. Hutchins, chief engineer, Philadelphia Trade and Convention Center; Mechanical Contractor J. M. Anderson of W. M. Anderson Co.

They planned air conditioning for a million people!

American Blower teams up with engineer and contractor to air condition Philadelphia's Convention Hall. Result: a system that provides indoor comfort for a million people a year.

On June 28, 1955, Philadelphia's famous Convention Hall (above) became the first facility of its kind in the U.S. to be fully air conditioned.

Everything about the system is on a fabulous scale. For example: The air-conditioned area is 202,500 sq. ft. It is designed for peak loads of 18,700 people. There is a complete air change every five minutes. System provides precise control of indoor temperature, humidity, odor level, air motion, air cleanliness in arena, stage, exhibition hall, grand ballroom, restaurant, foyer, corridors, etc.

Naturally, this complex job demanded top-notch air-handling and air-conditioning equipment. American Blower was chosen as a major supplier. Some reasons: says Consultant C. S. Leopold, "American Blower is a leader in the industry; its equipment is consistently reliable." Relates Air Conditioning Contractor J. M. Anderson, "We have found American Blower products to be among the best obtainable. They have been on our list of preferred suppliers for over fifty years."

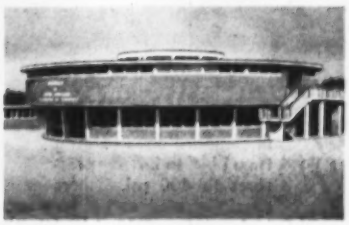
If *your* plans include air conditioning—whether it's a large-scale central or zone system, or a system for a small industrial plant or store—call your nearest American Blower branch office. You'll get quality products you can depend on, plus helpful local service every step of the way. American Blower Corporation, Detroit 32, Michigan. In Canada: Canadian Sirocco products.

AMERICAN BLOWER

Division of AMERICAN-Standard

Air-conditioning equipment for every business

Specify RECO



New field house at University of South Carolina—part of huge expansion program.

Hottest thing on S. C. Campus...Hot Water by RECO!

Last fall, 15 new RECO Hot Water Storage Heaters came to the University of South Carolina. They are the second generation of RECO heat exchangers to assure rust-free hot water for campus buildings. Since 1936, RECO has had a record of top performance with low maintenance at USC.

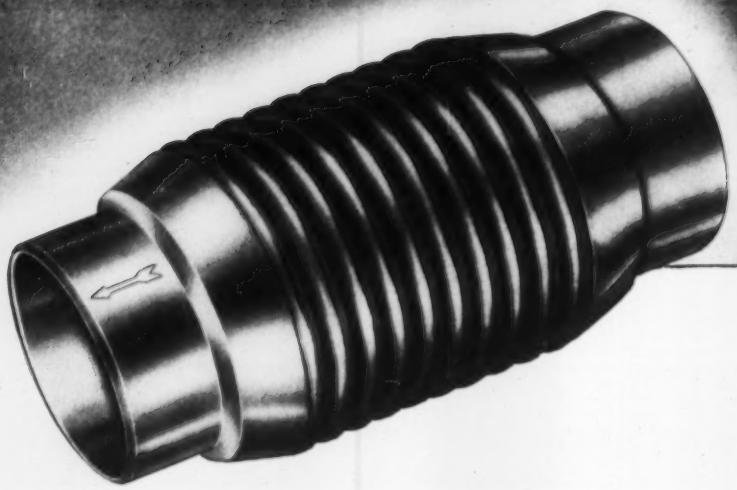
You can assure this same reliable hot water service to *your* clients. The RECO guarantee of quality, performance, fair price and quick delivery is known around the world. On your next heating job—SPECIFY RECO.

Write today for free catalogs plus name of RECO representative nearest you to: Dept. K, Richmond Engineering Co., Inc., 7th & Hospital Sts., Richmond 5, Virginia.

See Booth 156, Power & Mech. Eng. Show, N.Y. Coliseum, Nov. 26-30

RICHMOND ENGINEERING CO., INC.

New MULTI-PLY EXPANSION JOINT gives greater ELASTICITY



Here's an expansion joint that's really different—it's the BOA expansion joint with the exclusive patented multi-ply corrugated element. Its greater elasticity, flexibility and longer life is the result of the superior cold-forming properties of extremely light-gage stainless steel strip. This "layer on layer" construction of the corrugated element resulting in low reaction to mechanical forces, permits greater responsiveness to expansion and contraction.

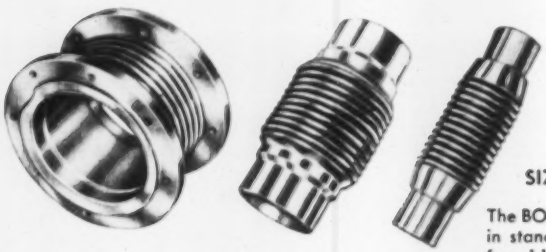
For your next piping job, investigate this superior product of Swiss engineering and see for yourself.

Write today for detailed and descriptive literature.

Exclusive

DISTRIBUTORSHIPS

If you are a distributor or contractor, — ask us about some of the exclusive territories still open.



SIZES

The BOA multi-ply is made in standard sizes ranging from 1 ½" to 24" for pressures to 400 psi. Others specially engineered for higher pressures and temperatures.

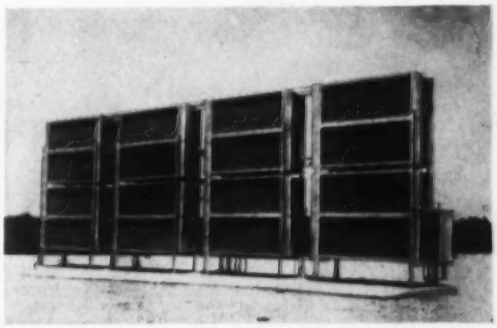
AMERICAN BOA multi-ply INCORPORATED

114 Liberty Street
New York, N. Y.

Crashing the 100 ton barrier

with KRAMER UNICON

in semi-tropical climate



UNICON SUCCESSFULLY MET THE TEST THROUGH THE SEVERE SUMMER OF 1955

You, too, can crash the big tonnage barriers with UNICON, the industry's finest remote-type air-cooled condenser. Put Kramer's 18 years of "treasured know-how" in the proper use of air as a condenser coolant to work for you.

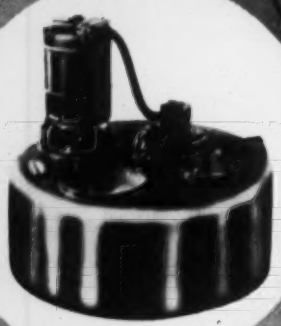
Photo of Kramer UNICONS mounted on roof of Handy-Andy Supermarket in San Antonio, Texas, used with 100 ton air conditioning system. Supplied through United Supply Co., of San Antonio and installed under the direction of Harold Vogt.

Write for Bulletin U-210-L

KRAMER

KRAMER TRENTON COMPANY
Trenton 5, New Jersey

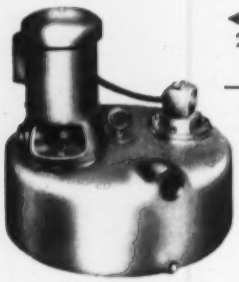
weil TVC



NEW
26 GALLON RECEIVER
for capacities to
15,000 Sq. Ft. E.D.R.

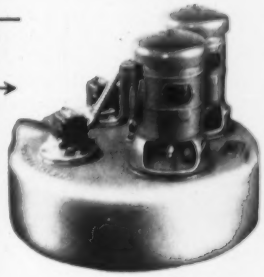
LOW RETURN CONDENSATE PUMP

Now Available with 26 GALLON CAST IRON RECEIVER



21" O.D. Receiver for single units

25½" O.D. Receiver for single or duplex units



LOW SPEED — 1750 RPM for long life

Unit Number	Max. Sq. Ft. Direct Radiation	Disch. Press. In Lbs. At Pump	GPM Radiation Will Condense	Capacity of Pump in GPM	Motor H.P.	Return Inlet in Inches	Pump Discharge in Inches	Diameter and Capacity of Receiver	Height of Return to Centerline
TVC-19	750	20	.38	1.5	¼	2	1	21" -10 Gal.	6⅞"
TVC-23	1000	20	.5	1.5	¼	2	1	21" -10 Gal.	6⅞"
TVC-29	2000	20	1.0	3.0	¼	2	1	21" -10 Gal.	6⅞"
TVC-35	4000	20	2.0	6.0	¼	2	1	21" -10 Gal.	6⅞"
TVC-41	6000	20	3.0	9.0	½	2	1	21" -10 Gal.	6⅞"
TVC-47	8000	20	4.0	12.0	½	2	1	25½"-15 Gal.	7⅛"
TVC-52	10000	20	5.0	15.0	¾	2	1	25½"-15 Gal.	7⅛"
TVC-54	15000	10	7.5	22.5	½	3	1¼	25½"-26 Gal.	10½"
TVC-55	15000	20	7.5	22.5	¾	3	1¼	25½"-26 Gal.	10½"
TVC-56	15000	30	7.5	22.5	1	3	1¼	25½"-26 Gal.	10½"
TVC-57	15000	40	7.5	22.5	1½	3	1¼	25½"-26 Gal.	10½"

With these weil TVC Pumps, radiation may be placed as low in the building as desired. Underground gravity return lines are eliminated and overhead discharge lines used. The built-in durability, ease of installation, low cost and efficient operation of the TVC Pump warrants its selection for new installations or replacements.

Now available in Jobbers' Stocks

weil PUMP COMPANY

Send for Bulletin TVC-300

1514 No. Fremont Street
Chicago, Illinois

here's the new

Mark of Distinction

symbolizing White-Rodgers famous standard of quality in controls for modern comfort

Raymond Loewy, internationally famous industrial designer

styled by **RAYMOND LOEWY ASSOCIATES . . .**

world's largest firm of industrial designers . . . whose internationally famous creative talents have developed new prestige and sales for some of America's most distinguished products.

Look for this trademark . . . you'll be seeing it everywhere . . . on White-Rodgers heating, refrigeration and air conditioning controls . . . on cartons, boxes, labels, catalogs and new products.

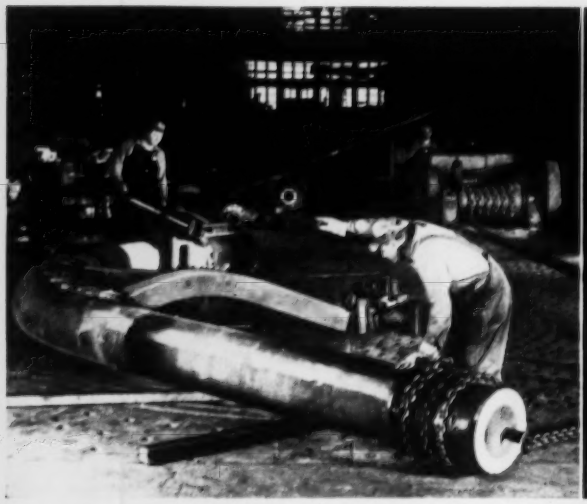
One of the first products to display the new Mark of Distinction is the NEW *Fashion* Thermostat—most exciting design idea in thermostats . . . in years.

AUTOMATIC CONTROLS for heating, air conditioning and refrigeration

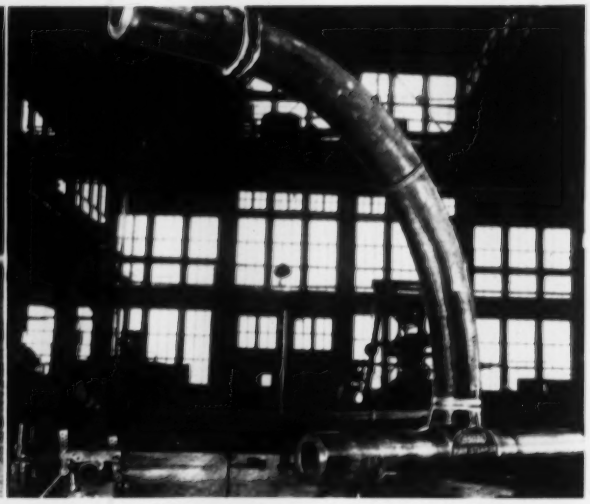
WHITE-RODGERS

ST. LOUIS 6, MISSOURI

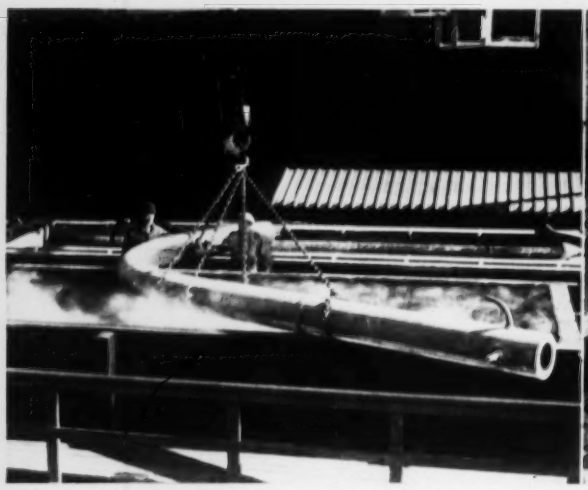
TORONTO 8, CANADA



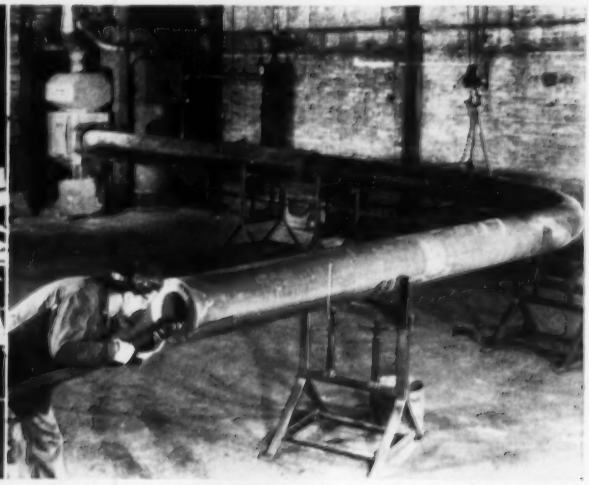
Crane's skilled shopmen bend 17¼" O.D. pipe with 3¼" wall. Pipe bend is for steam service—1970 lbs. at 1050 deg. F.



Experienced Crane welders have welded the bend (see photo 1) to header. Pipe is 2¼% chrome, 1% moly, alloy steel. Unit shown weighed 15,000 lbs.



Pipe bend fabricated by Crane is being pickled as part of cleaning procedure. Pipe is chrome-moly alloy—2.539" wall thickness; 13.578" O.D. Unit weighs 9050 lbs.



Pipe shown at left also was shot-blasted. Combining pickling and shot-blasting assures maximum interior cleanliness.

Let CRANE fabricate your heavy-wall pipe

Do your high pressure-high temperature piping specifications call for bending and fabricating pipe of greater wall thicknesses than the maximums shown in Schedule 160 thicknesses?

—Crane shops for years have been processing heavy-wall pipe ranging in thicknesses up to 3.750"; in O.D. pipe sizes from 11.690" to 21.000"!

Crane facilities include bending, welding, upsetting, machining, full furnace stress-relieving or heat treating, radiographic inspection, and thorough interior cleaning.

All Crane facilities are housed under *one* roof for fastest service—and controlled and operated under *one* responsibility. Thus, you are assured of traditional Crane quality in materials, engineering supervision, and skilled shopmanship—that effect important economies in erection, operation, and maintenance for years to come.

For prompt consultation write to address below.

CRANE FABRICATED PIPING

VALVES • FITTINGS • PIPE • KITCHENS • PLUMBING • HEATING

Since 1855—Crane Co., General Offices: Chicago 5, Ill. Branches and Wholesalers Serving All Areas

Young

gives you ALL the features you want in baseboard heating

DAMPER or SPLITTER (optional) can be installed at any time—now or later. Dampers are held in place by retainers snapped into top groove and can be set in any position from fully open to fully closed. Splitters attach to support brackets.

ONE-PIECE BACK AND TOP facilitates easy installation—eliminates air leakage and streaking. Cabinet is suitable for surface mounting or partially recessed installation.

FRONT COVER has smooth, easy-to-clean surface—snaps firmly into place without screws yet is easily removable for access.

HIGH-CAPACITY HEATING ELEMENT consisting of aluminum fins mechanically bonded to copper tube. Fin collars and tube form a double-walled continuous heat transfer surface that assures maximum heating efficiency.

SUPPORT BRACKET for front cover and element hanger is specially designed to support and facilitate the installation of a by-pass or return tube entirely within the cabinet.

HANGER support and cushion strip allows heat-element to move noiselessly with expansion and contraction.

Young Convector-Radiators

Free-Standing

Partially Recessed

"Perimaheat" BASEBOARD BY Young

Write Dept. L-616 for Catalog No. 4354A

Whether it's performance, low cost, installation ease or appearance, *Perimaheat* baseboard by Young fills the bill for every requirement. Designed for high capacity, perfectly controlled heating with inconspicuous, space-saving cabinets, *Perimaheat* provides clean, efficient heating for homes, offices and institutions. See the yellow pages of your telephone directory for nearest Young Radiator Company representative. Or, write YOUNG RADIATOR COMPANY, Dept. L-516, Racine, Wis.

Perimaheat is a Young Radiator Company trademark

Fully Recessed

Wall-Hung

Low-Level

Young RADIATOR COMPANY

RACINE, WISCONSIN

Creative HEAT TRANSFER ENGINEERS FOR INDUSTRY

Heat Transfer Products for Automotive, Aviation and Industrial Applications.

Heating, Cooling, Air Conditioning Products for Home and Industry.

Executive Office: Racine, Wisconsin, Plants at Racine, Wisconsin, Mattoon, Illinois

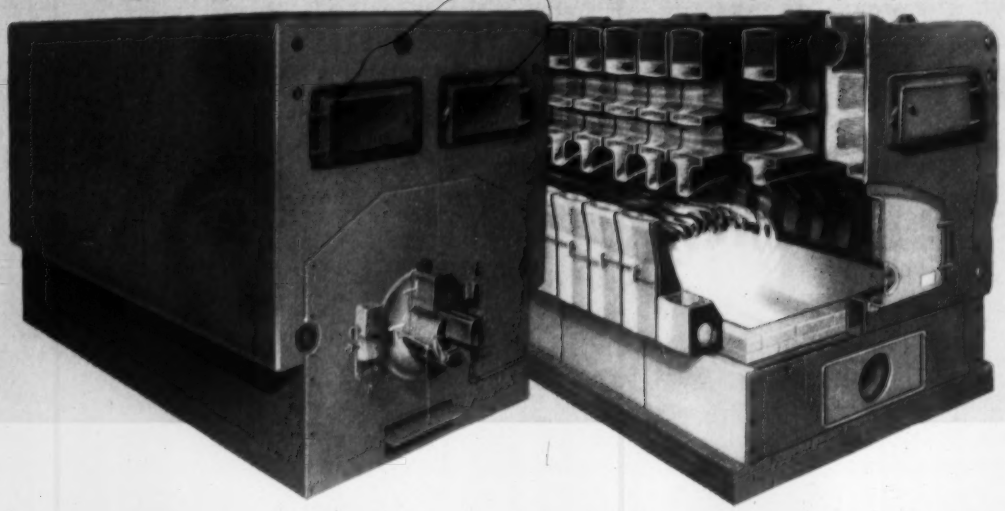
CMA

The Young Radiator Company is a member of the Convector Manufacturers Association and subscribes to the engineering standards of that association.

FOR HEAVY DUTY

AT LESS COST

Savings in installation, boiler room space, maintenance and operating cost are a few of the reasons why Weil-McLain Heavy Duty Boilers have achieved a reputation for low cost, dependable service. These boilers are ideal for both new buildings and replacement jobs and offer many efficiency features unequalled by competitive makes.



HR SERIES BOILERS

FOR HORIZONTAL ROTARY OIL BURNERS

In the HR Series, Weil-McLain makes a notable advance in boiler design. They are ASME constructed, *cast iron* units, engineered to provide the best operating conditions for burning low-cost, heavy oils. These boilers were designed in cooperation with leading makers of horizontal rotary oil burners and have their approval.

The HR Boiler is distinguished by numerous exclusive features. Its large firebox volume develops better combustion conditions and assures maximum radiant heat transfer. The high base makes more combustion space available—eliminates a high brick foundation. A special steel front plate simplifies installation of rotary burners and the heavily insulated steel jacket saves insulating time.

For complete information send for Bulletin C-188.

40 AND 44 SERIES BOILERS

FOR OIL, GAS AND STOKER FIRING

These heavy duty boilers are noted for efficient performance, ease of installation, minimum servicing requirements and long life. They have an excellent reputation for economical operation in institutional, commercial and industrial installations.

Extra primary heating surface and balanced gas travel in the flueways assure maximum radiant and convected heat transfer. The base may be extended to provide the additional space required by automatic firing.

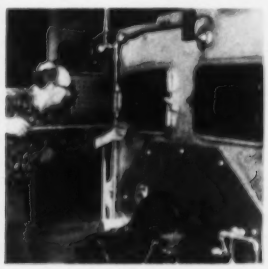
Short draw-rod construction permits rapid assembly and simplifies the adding of sections if enlarged capacity is required. Sectional construction also permits boiler erection without special equipment. Weil-McLain Series 40 and 44 Boilers can be readily converted from one fuel to another. Send for Bulletin C-186!

All Weil-McLain Heavy Duty Cast Iron Boilers have these *"Extra Value"* features

When installing or adding capacity to boiler, sections can be moved through an ordinary door.

Joining the sections by short draw-rods simplifies erection and makes a strain-free assembly.

For boiler replacement or in adding to boiler capacity, sectional construction makes installation easier.



Generously sized clean-out doors give complete access to flueways—easy to keep boiler at top efficiency.

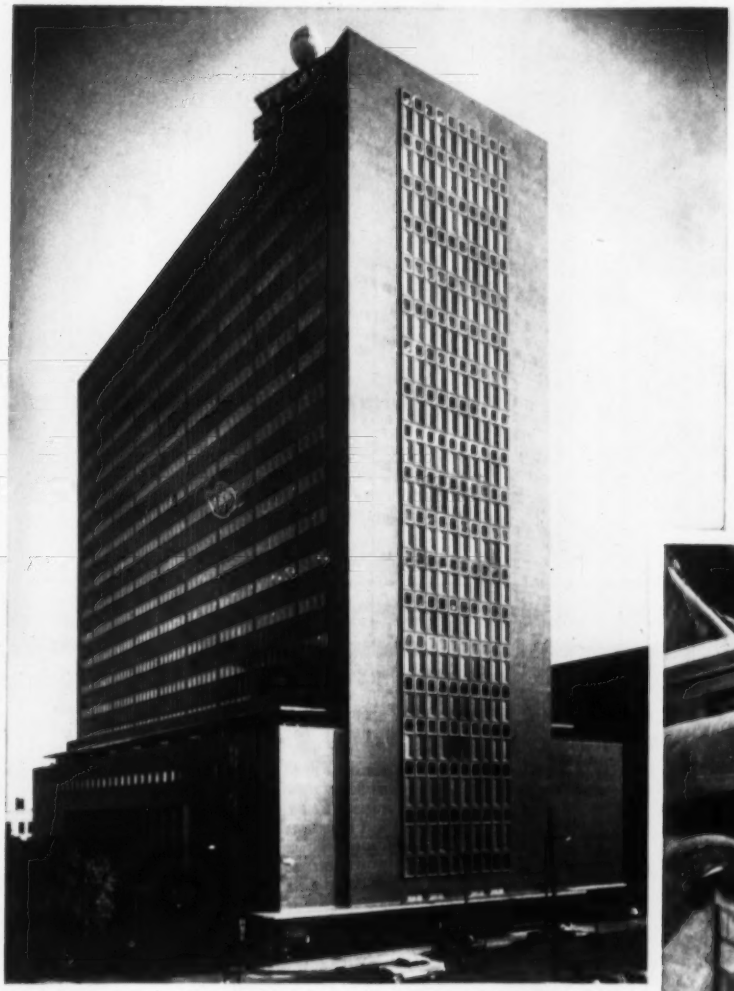
WEIL-McLAIN MICHIGAN CITY, INDIANA

WEIL-McLAIN BOILERS · RADIATORS

Address literature requests to Dept. AA-116

NATIONAL SEAMLESS PIPE

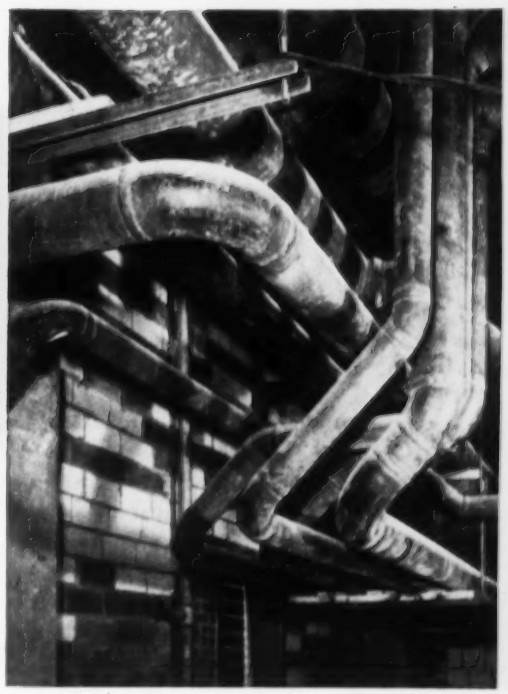
used for heating and air conditioning system of new Texas National Bank Building



USS National Seamless Pipe, in sizes from 4" O.D. to 16" O.D., was utilized in the heating and air conditioning system of this new Houston, Texas, building, owned jointly by Texas National Bank and Continental Oil Co., as follows:

Sizes 4", 6", 8", 10" and 12" are used for combination hot and chill water lines to the primary and zone conditioners as well as the perimeter units. The 16" O.D. pipe is used for handling condenser water.

The 14" O.D. pipe is part of the steam piping system which in turn converts the water into hot water for heating through the use of converters.



USS National Seamless Pipe is consistently the number one choice of engineers and contractors throughout the country for air conditioning, heating and power installations. Its ability to render efficient, trouble-free service under all types of pressure and temperature conditions has given National Seamless a reputation for safety and dependability excelled by no other pipe. For further information, or assistance with your pipe problems, get in touch with our engineers.

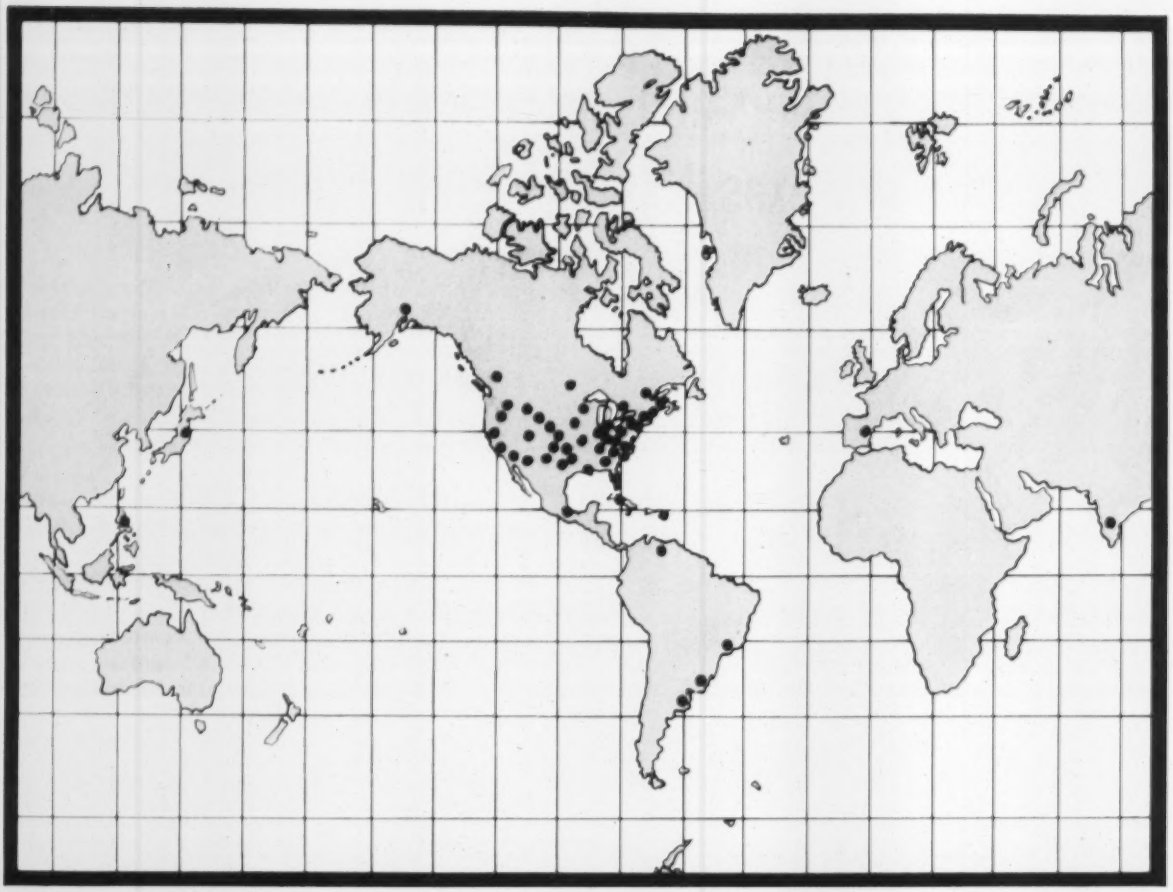
NATIONAL TUBE DIVISION, UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.

COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS · UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS

NATIONAL Seamless PIPE AND TUBES

UNITED STATES STEEL



RIC-WIL offers WORLD WIDE

Service for Prefabricated Piping Systems

Over 75 field offices, both national and international are at your disposal on any project dealing with prefabricated piping systems. These field representatives offer on the spot assistance in planning, delivering and installing underground or overhead piping. A Ric-wiL representative will be glad to discuss plans involving steam, hot water or oil distribution lines . . . and he represents the world's largest supplier of prefabricated piping systems.

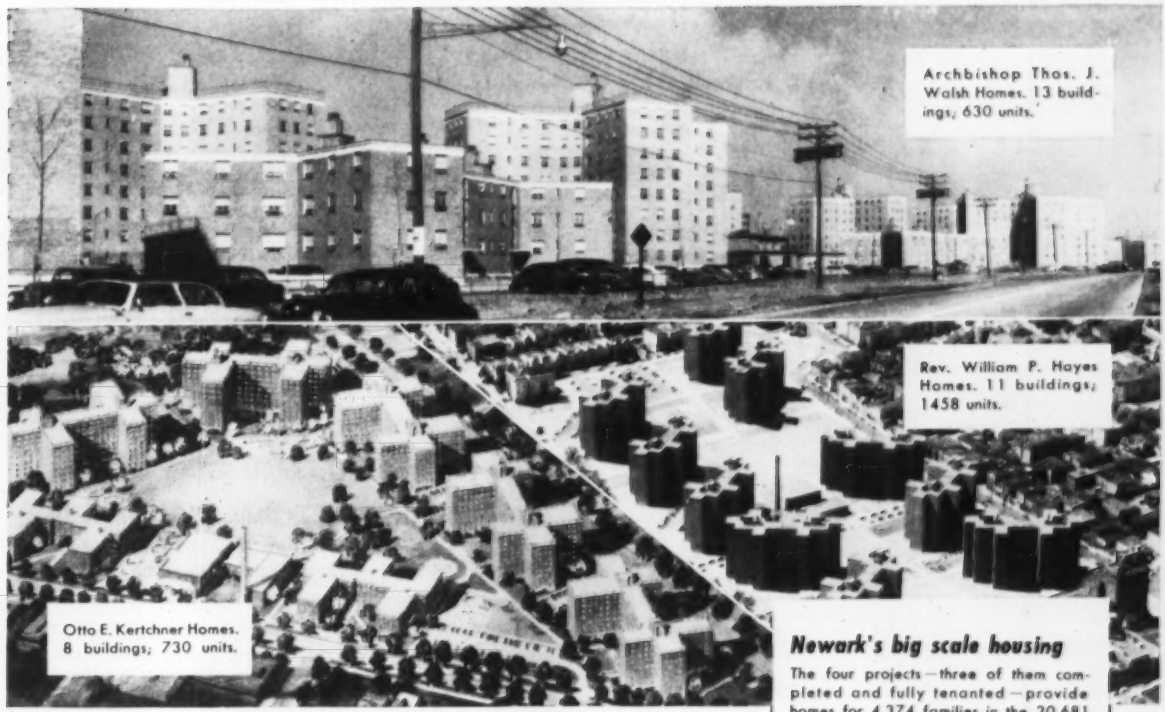
For the name of your nearest representative or the catalog covering the Ric-wiL line, call or write the home office.

Quality Piping Systems . . .
. . . of Exceptionally High Thermal Efficiency
SINCE 1910

RIC-WIL INCORPORATED — PREFABRICATED INSULATED PIPING SYSTEMS

BARBERTON, OHIO

IN CANADA: THE RIC-WIL COMPANY OF CANADA LIMITED


Archbishop Thos. J. Walsh Homes. 13 buildings; 630 units.
Rev. William P. Hayes Homes. 11 buildings; 1458 units.
Otto E. Kertchner Homes. 8 buildings; 730 units.

Thousands of MARSH Valves and Traps for this big Newark project!

A bright spot in the dark clouds that overhang Humanity is America's big drive to solve the housing problems of congested cities.

The development pictured here is in Newark. It consists of four projects, comprising a total of 41 big buildings containing more than 20,000 rooms. The four developments provide about five rooms each for over 4,000 families—enough dwelling units to house the entire population of a city of nearly 20,000 people.

Naturally, in buildings like these it is necessary for the sake of initial economy to rule out frills and embellishments. But never forget that the vital need for long-range economy dictates *highest quality in every basic element of construction.*

That is why only the best heating equipment is used in the four big central heating systems. That is why the systems are equipped throughout with thousands of Marsh Radiator Valves and Traps—the kind that will stand up across the years.

Yes, in buildings of every size and kind you will find Marsh Valves, Traps and Vents . . . selected by men who know the economy of using only the best. Let the Marsh man work with you on your next job.

MARSH HEATING EQUIPMENT CO. *Sales affiliate of Jas. P. Marsh Corporation* Dept. T, Skokie, Ill.

Marsh Instrument & Valve Co. (Canada) Ltd.
8407 103rd St., Edmonton, Alberta

Newark's big scale housing

The four projects—three of them completed and fully tenanted—provide homes for 4,374 families in the 20,681 rooms of 18 12-story; 13 8-story, 1 7-story, and 5 3-story buildings. The project is described as:

Housing Authority,
City of Newark, N. J.
David Kent, Dir. of Development — Louis Danzig, Exec. Dir.
Steve Galaida, Mechanical Engineer

The projects are:

1. Otto E. Kertchner Homes
   General Contractor: HRH Construction Co., New York, N. Y.
   Heating Contractor: John H. Joyce, Newark, N. J.
2. Archbishop Thos. J. Walsh Homes
   General Contractor: Terminal Construction Co., Wood Ridge, N. J.
   Heating Contractor: John Cooney, Harrison, N. J.
3. Rev. William P. Hayes Homes
   General Contractor: Terminal Construction Co., Wood Ridge, N. J.
   Heating Contractor: Paramount Plbg. & Htg. Corp., New York, N. Y.
4. Christopher Columbus Homes
   General Contractor: Terminal Construction Co., Wood Ridge, N. J.
   Heating Contractor: Paramount Plbg. & Htg. Corp., New York, N. Y.

The Christopher Columbus group of 8 12-story buildings is not illustrated, but is now completed.

The great combination: Marsh packless—*truly packless*—radiator valve and the trouble-free Marsh thermostatic trap.

The Marsh float and thermostatic trap. There is a Marsh trap for every heating service.

MARSH *Quality Heating Specialties* **SINCE 1865**

the ALL-AROUND VERSATILITY

PLUS values in power

of the HOWELL series one hundred motor line

gives you A WIDE RANGE OF MOUNTINGS AND ELECTRICAL CHARACTERISTICS TO FILL YOUR PARTICULAR MOTOR NEEDS

TOTALLY ENCLOSED FAN-COOLED

OPEN DRIP-PROOF

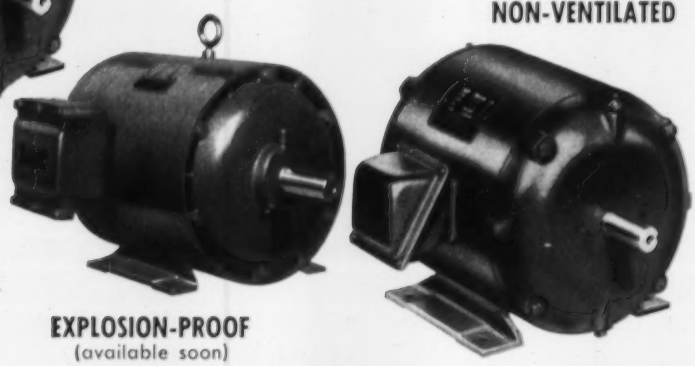
To meet your job requirements exactly, the new Howell Series 100 motors are available in each of the five standard constructions illustrated here. And under their streamlined good looks lie a wealth of "plus values" in construction that make these rerated motors your best buy for long range dependability.

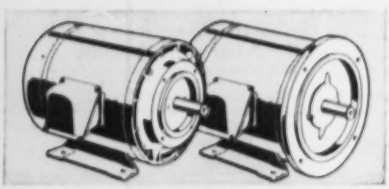
Beyond mountings, there's a broad range of electrical types and mechanical combinations that are accommodated readily by the basic Series 100 design. A partial list is as follows:

Normal torque
High torque, compressor duty
Punch press, elevator and crane hoist
Multi-speed
Reluctance synchronous
Single phase
Torque motors
Brake motors
Part Winding
Rapid reversing
Special application
Gear motors

SPLASH-PROOF and WEATHER-PROTECTED

TOTALLY ENCLOSED NON-VENTILATED





C-FACE D-FLANGE
P-BASE

EXPLOSION-PROOF
(available soon)

For more details on Series 100 motors, write for Bulletin N-100-R

HOWELL Red Band MOTORS

HOWELL MOTORS

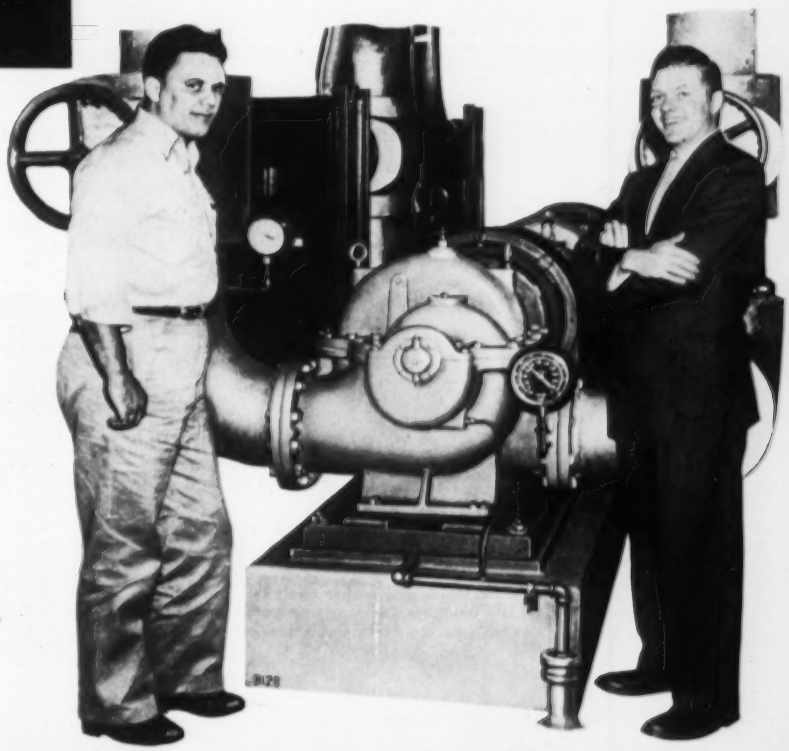
PRECISION-BUILT MOTORS FOR INDUSTRY SINCE 1915

HOWELL ELECTRIC MOTORS COMPANY, HOWELL, MICHIGAN

DE LAVAL

CENTRIFUGAL PUMPS

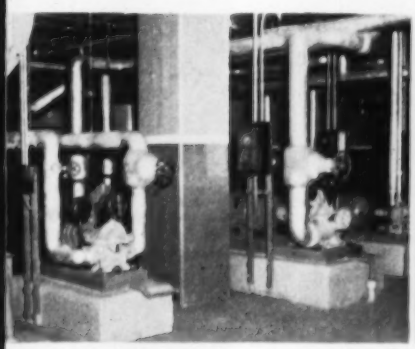
selected by contractor for "long service at low cost"



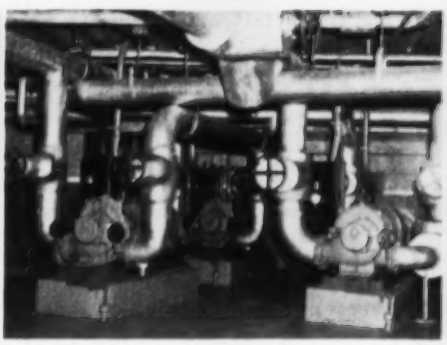
Ten De Laval centrifugal pumps were installed in the new Shell Oil Building, New Orleans, La. by Emile M. Babst Company, the Mechanical Contractor. "De Laval pumps were selected," Babst reports, "because we know that we can count on their dependability. They are built to give long service at low cost."

De Laval single stage centrifugal pumps are being used for a wide variety of applications in commercial and industrial buildings. For complete data on these units, write for Bulletin 1002.

Shown are Edmund Dolese, Chief Building Engineer (at left) and Robert Ralston of the Emile M. Babst Company, Mechanical Contractor (at right). Architects—August Perez & Associates, Consulting Engineers—Leo S. Weil & Walter B. Moses, General Contractor—Gervais F. Favrot Co., Inc.



A



B

C

The new 14-floor Shell Oil Building in New Orleans has 300,000 sq. ft. of rental area, which is occupied by 45 tenants.

A Two De Laval GS pumps are used for hot water circulating. They operate at 75 gpm and 30 ft. head.

B Four De Laval K pumps are used for coil water service (1800 gpm and 168 ft. head) and condenser water service (2430 gpm and 130 ft. head).

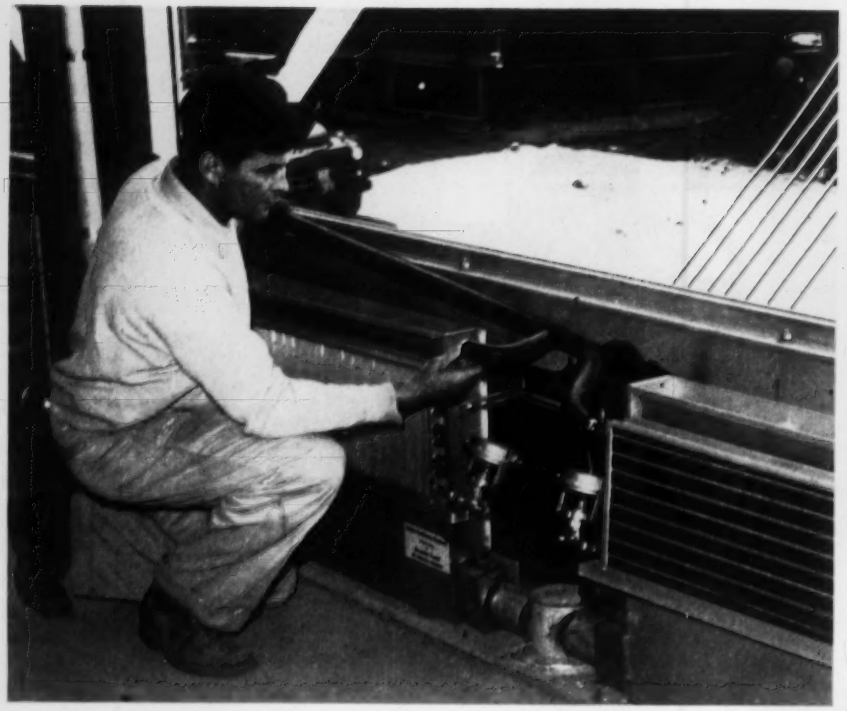
C Four De Laval I pumps are used for cooling tower make-up (115 gpm and 145 ft. head) and house pump service (270 gpm and 174 ft. head).

DE LAVAL *Centrifugal Pumps*

DE LAVAL STEAM TURBINE COMPANY

871 Nottingham Way, Trenton 2, New Jersey

DL-261



Remarkably flexible, Armaflex is simple and neat to apply to air-conditioning systems such as this one at the Connecticut General Life Insurance Company's new office building in suburban Hartford, Conn. Armaflex's cellular structure seals out moisture and air, prevents condensation.

Slipped right over lines before they're put into operation, Armstrong Armaflex follows contours readily without time-consuming special cutting or fitting.

Joints are cemented with Armstrong 520 Adhesive. When they are required, fitting covers can be easily fabricated from miter-cut pieces of Armaflex.

Pre-insulated with Armaflex, these heating-cooling lines are ready to be connected to the air-conditioning units. No further insulation is needed.

New insulation for fluid cooling and heating lines is

flexible for fast, easy application

The great flexibility of Armstrong Armaflex® permits fast, easy insulation of both commercial and residential air-conditioning and heating lines. Made of a resilient, foamed plastic, Armaflex slips right over pipes and copper tubing, follows contours without special cutting or fitting. If lines are already in operation, just slit Armaflex lengthwise, snap in place, and seal with Armstrong 520 Adhesive. No separate vapor barrier is needed.

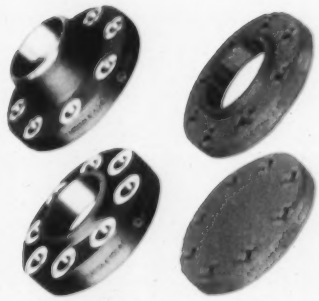
Fitting covers can be quickly fabricated from miter-cut pieces and cemented together. Armaflex is clean to work with, too. It will not chip, crumble, or rub off; waste is negligible. A self-extinguishing feature makes Armaflex completely safe to install before sweat fittings are made.

Highly efficient, Armaflex in ½" wall thickness prevents condensation under normal design conditions on indoor lines operating as low as 32° F. Its low k-factor of 0.28 at 75° F. stays low for the life of the installation. Armaflex comes in 6' lengths, for pipes and tubing up to 3⅛" i.d.

For free booklet containing complete data on this remarkable new insulation, write to Armstrong Cork Co., 2011 Sherman Street, Lancaster, Pa.

Armstrong
INDUSTRIAL INSULATIONS

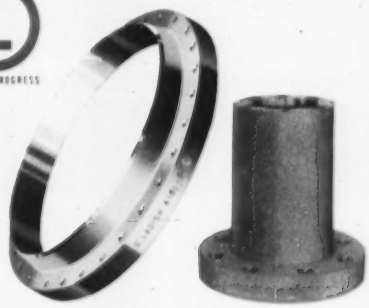
BUTT WELDING FITTINGS
(IPS)



ASA and MSS FLANGES

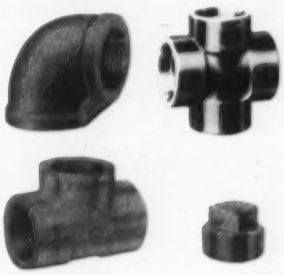
TO MARK PROGRESS

BUTT WELDING FITTINGS
(TUBE O.D.)



LARGE O.D., TEMA and
LONG WELDING NECK FLANGES

UNIONS



SCREWED and SOCKET FITTINGS

LADISH

FOR *Complete Service* IN *Controlled Quality* FITTINGS

CARBON • ALLOY
AND STAINLESS STEELS

WHATEVER your fittings requirements . . . regardless of the type, size, wall thickness, pressure rating or material specification . . . you can get prompt, efficient, *complete service* by specifying LADISH and ordering from your local Authorized Ladish Distributor.

A broad, full-range line produced to unsurpassed standards of metallurgical and manufacturing integrity . . . plus adequate local stocks . . . gives you double assurance of satisfaction.

For complete service on your fittings requirements . . . call your Authorized Ladish Distributor.

Catalogs available on request. Please indicate specific product lines for which information is desired.

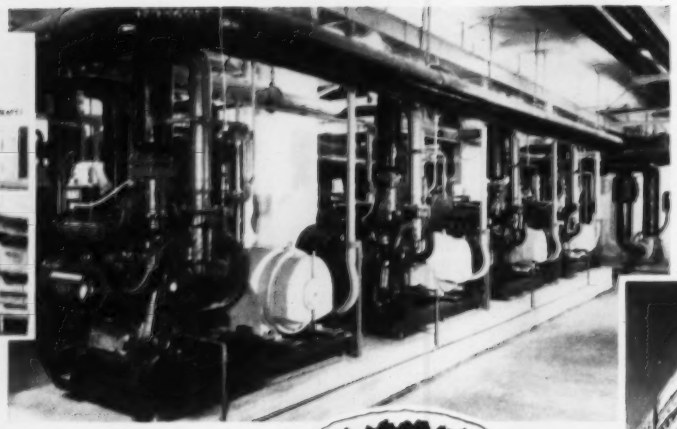
THE COMPLETE *Controlled Quality* FITTINGS LINE

LADISH CO.

CUDAHY, WISCONSIN
MILWAUKEE SUBURB

District Offices: New York • Buffalo • Pittsburgh • Philadelphia • Cleveland
Chicago • St. Paul • St. Louis • Atlanta • Houston • Odessa • Tulsa • Denver
Los Angeles • San Francisco • Seattle • Havana • Mexico City • Stratford, Conn.

Frick unit air conditioners are built in 3, 5 and 7½ horsepower sizes.



Eight Frick "ECLIPSE" compressors, each with nine cylinders, air condition both the 11-story buildings of the American National Insurance Co. in Galveston, Texas.

TRADE FRICK MARK®

Air Conditioning and Refrigeration

The Industry's Most Complete Engineering Service

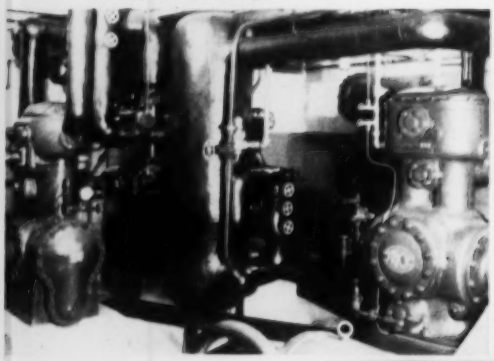
Including surveys, sales-engineering, design, manufacture, shipment, installation, and maintenance.

Built into Frick equipment are 50 years' experience in air conditioning, 74 in refrigeration, and 103 in engineering. Nowhere else can you get this combination of unique engineering experience, complete systems and complete service—on any commercial or industrial cooling load, with any refrigerant, at any temperature!

Branches and distributors the world over: write for literature and estimates today.

Fragmented Shell-Ice is produced automatically: plants making block ice available in any size.

Below: Ammonia booster systems save power on quick-freezing work.

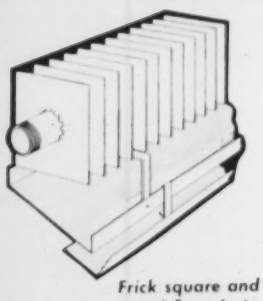


DEPENDABLE REFRIGERATION SINCE 1882

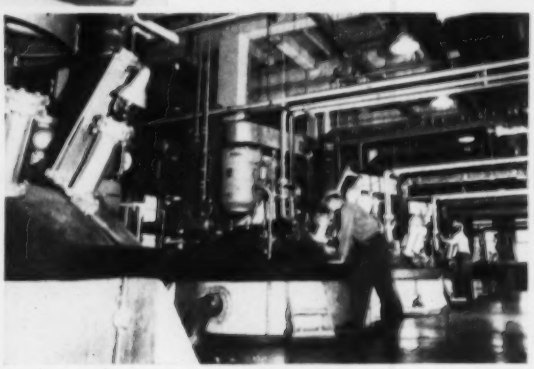
FRICK CO.

WAYNESBORO, PENNA. U.S.A.

Synthetic-rubber reactors handle batches over twice as fast when cooled with patented Frick coils.



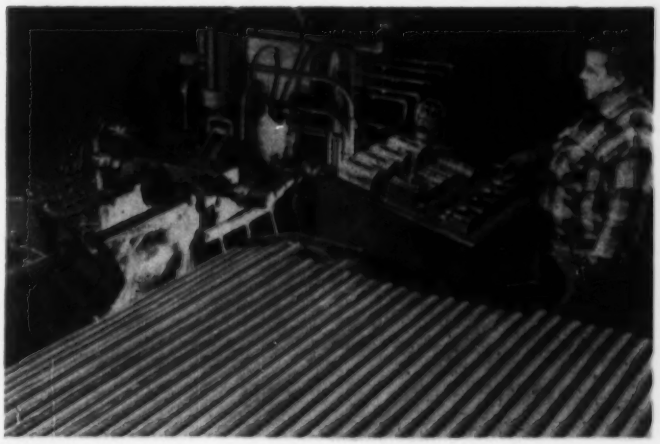
Frick square and spiral finned pipes save valuable space.



In writing for literature, please describe the cooling work you wish to do.

These Men at ETNA Make Sure Your SPANG CW Steel Pipe Is TOP-QUALITY

These testing and inspection experts at Etna represent you at the mill to be sure you get *top-quality* pipe every time you order SPANG CW Steel Pipe. Careful control like this is a habit at SPANG, and that's why *quality-controlled* SPANG CW is your best buy for every type of piping installation. See your local SPANG Distributor for your next pipe order!



Meet Al Badack, a member of the day-turn testing team at SPANG'S Etna (Pa.) Plant. Al, who has worked at SPANG for nine years, is applying the hydrostatic water test to two lengths of SPANG CW Steel Pipe. Test pressures are applied at readings well above actual *working pressures* for which the pipe is designed. This hydrostatic test assures you that each length of *top-quality* SPANG Pipe you buy has a strong weld and will more than meet your pressure specifications.

SPANG

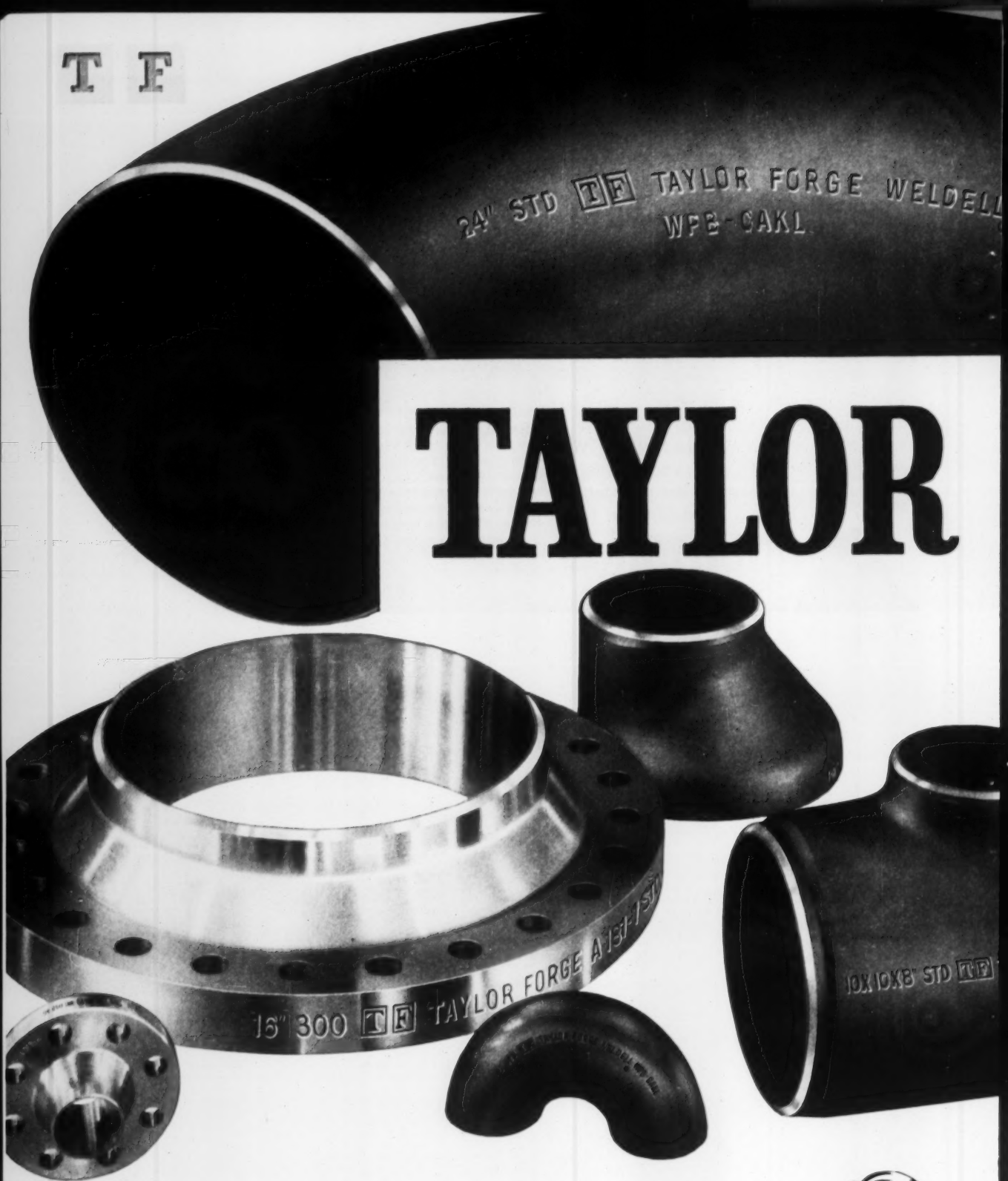
SPANG-CHALFANT

DIVISION OF THE NATIONAL SUPPLY COMPANY

General Sales Office: Two Gateway Center, Pittsburgh, Pa. District Sales Offices: Atlanta, Boston, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis

These men a .s Chester Galda and Steve Ajjnich, two members of SPANG'S inspection team at Etna. Chester, a 22-year man with SPANG, is surface-inspecting coupling fit-up of SPANG CW Steel Pipe. Steve, a veteran of 44 years with SPANG, inspects each length with the aid of a fluorescent light to be sure the threads and the pipe are uniform and free of any defects. Any length that does not meet SPANG'S *top-quality* specifications is rejected.

T F



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Welding nozzles

T.E.M.A. flanges and channels

Multiple outlet headers

Production forgings

Venturi reducers

Spiral weld pipe

Large diameter electric weld pipe

Welding necks

By any method of value analysis...
By any measurement of quality...
By any standard of comparison...

IT PAYS TO BUY

FORGE Welding Fittings and Forged Flanges

There are good, sound reasons for the high esteem in which Taylor Forge Welding Fittings and Forged Flanges are held everywhere . . . why they always "measure up" in any comparison of quality or value.

The dimensional accuracy, excellent metallurgical properties and fine design of these products are the result of Taylor Forge's fifty odd years of experience in the forging and forming of metal, in research and in the development of techniques, skills and production facilities.

That's why . . . for everything in Welding Fittings and Forged Flanges . . . every type, size, thickness, material and pressure rating . . . it pays to turn to Taylor Forge . . . TRADITIONALLY DEPENDABLE

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General Offices and Works: P. O. Box 485, Chicago 90, Illinois

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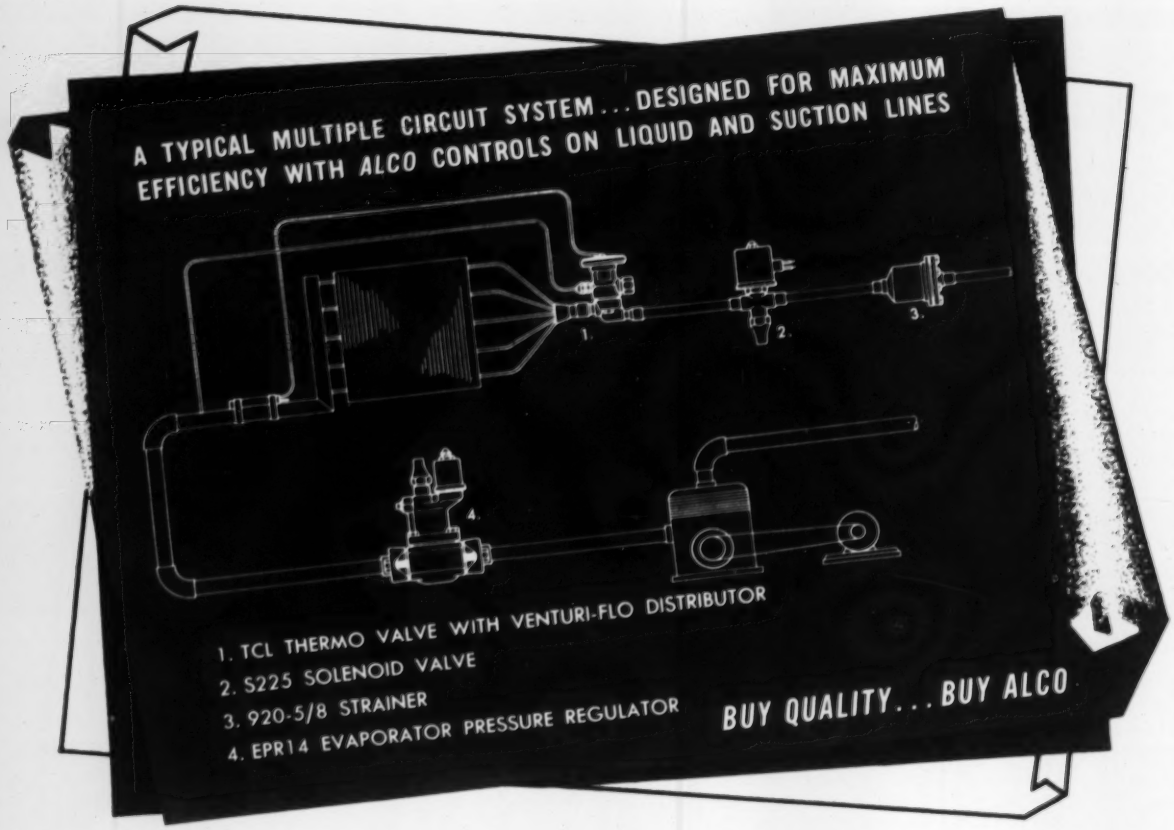
To take full advantage of both product excellence and fine service patronize your local Taylor Forge Distributor.

ALCO MAKES

every fluid control you need

...for any refrigeration system


A TYPICAL MULTIPLE CIRCUIT SYSTEM... DESIGNED FOR MAXIMUM EFFICIENCY WITH ALCO CONTROLS ON LIQUID AND SUCTION LINES
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3.
4.
1. TCL THERMO VALVE WITH VENTURI-FLO DISTRIBUTOR
2. S225 SOLENOID VALVE
3. 920-5/8 STRAINER
4. EPR14 EVAPORATOR PRESSURE REGULATOR
BUY QUALITY... BUY ALCO

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ALCO VALVE CO.

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THE MARK OF QUALITY

BARBER COLMAN

uni-flo

Engineered Air Distribution

Get *Guaranteed* performance with Venturi-Flo ceiling diffusers

BARBER-COLMAN 1020 MODEL JS VENTURI-FLO
VELOCITY-TEMPERATURE TRAVERSE THROUGH VERTICAL PLANE

A Vel.	A Temp.	B Vel.	B Temp.	C Vel.	C Temp.	D Vel.	D Temp.	E	F Vel.	F Temp.	G Vel.	G Temp.	H Vel.	H Temp.	I Vel.	I Temp.	
30	73.0	55	71.5	55	70.8	55	70.4	25	72.0	70	69.5	55	70	55	70	30	71.5	9'-6"
40	71.2	25	72.0	30	72.5	30	72.5	25	72.0	25	72.0	35	71.5	30	71.6	35	71.5	7'-6"
50	71.5	25	72.3	25	72.0	25	71.9	40	71.9	30	71.9	30	72.0	30	72.2	30	71.9	5'-0"
40	72.2	35	71.9	35	72.2	30	72.0	35	72.0	35	72.0	30	72.5	35	72.0	50	71.9	2'-6"
50	72.5	60	71.5	45	71.2	45	71.5	30	72.0	45	72.9	50	72.5	40	72.9	50	71.9	6"

SUPPLY AIR VOLUME — 545 CFM
SUPPLY AIR TEMPERATURE — 51.8°F
AVERAGE ROOM AIR TEMPERATURE — 72.0°F AT THE 5' LEVEL

Opposed-blade volume control is easily operated through face of diffuser.

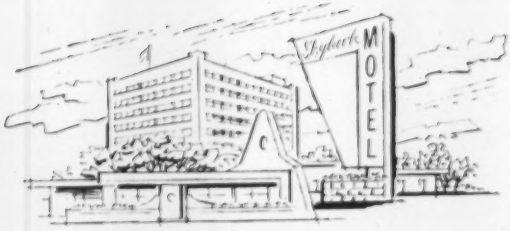
Simple adjustment provides air patterns from horizontal to vertical.

The uniform, draft-free air distribution pattern charted above is typical of the results you can predict with Venturi-Flo Ceiling Diffusers. With Venturi-Flo, the mixing of primary air with room air takes place throughout the entire length of the throw. This permits even higher temperature differentials than shown in the traverse above. Barber-Colman guarantees performance of Venturi-Flo Ceiling Diffusers when they are used according to published data. Contact your nearby Barber-Colman field office or write . . .

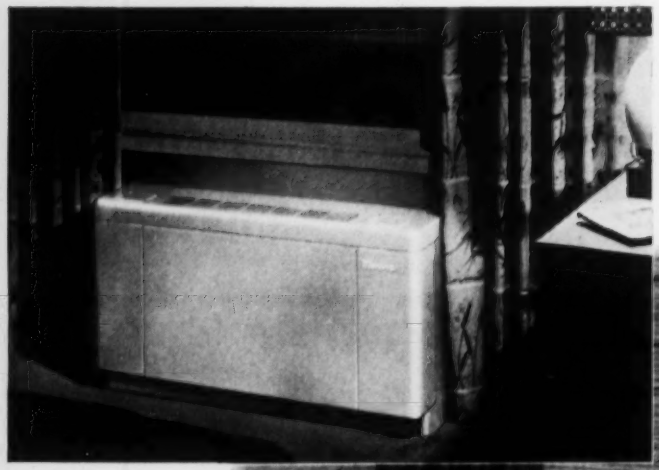
Barber-Colman Company

DEPT. K, 1101 ROCK STREET, ROCKFORD, ILLINOIS, U. S. A.

New construction . . .



or modernization



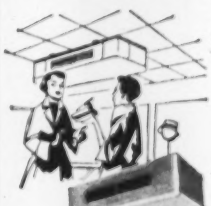
Modine AIRditioners are the quiet, fingertip answer to year-round comfort

Successfully combining the most desirable features of *central* and *unit type systems*, Modine AIRditioners have earned wide acceptance among architects, engineers and contractors. Whether it's a new or remodelling job, these men like the individual room control — with the economy of operating from a central boiler and chiller. Slow-speed, resiliently mounted fans provide extra-quiet year-round comfort. And, like all Modine products, AIRditioners are designed and built to meet highest appearance and mechanical standards.

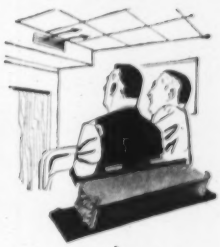
Ask the Modine representative listed in your classified phone book for Bulletin 755 — or write Modine Mfg. Co., 1509 DeKoven Ave., Racine, Wisconsin.
A-1336

Modine Airditioners®

In Canada: Sarco, Ltd., Toronto

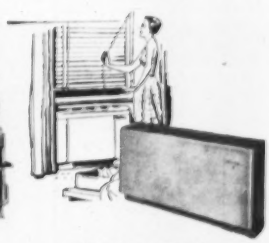


CEILING MODELS
deluxe units for exposed overhead installation. Save floor and wall space.



OVERHEAD MODELS
available with or without plenum and filters for use in furred overhead space.

CONCEALED MODELS
(front panel cut away). Designed for easy, in-the-wall installation below windows.



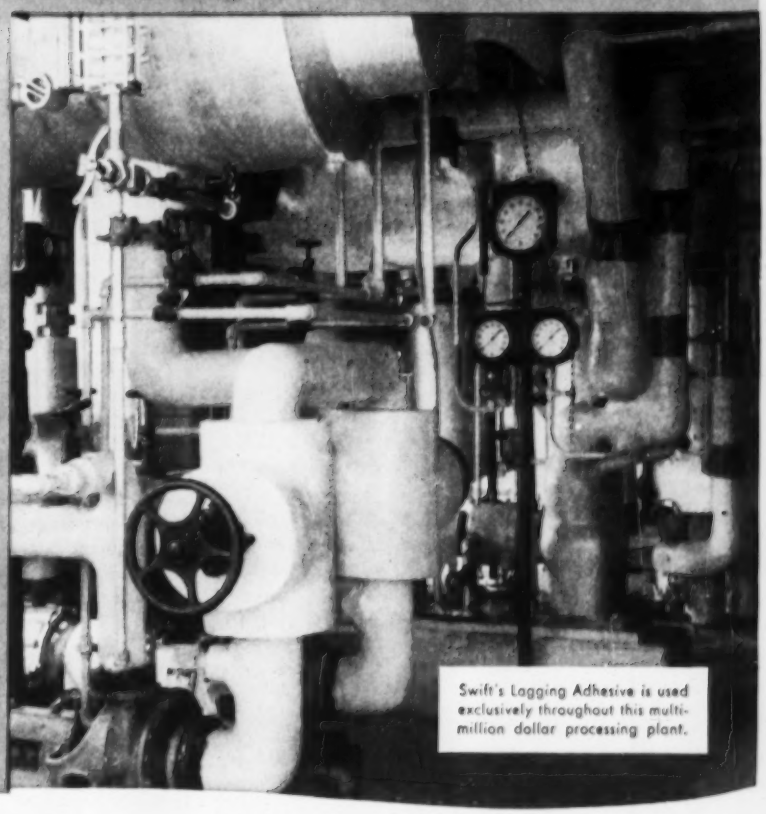
CONSOLE MODELS
free standing units can also be recessed so only 6 inches of cabinet shows.

Swift's *improved* LAGGING ADHESIVES

for:
- Bonding molded insulation to pipes, tanks, etc.
- Binding loose insulation and adhering to pipes, tanks, etc.
- Adhering lagging cloth to insulation
- Sizing lagging cloth after application to insulation

give you *TWELVE IMPORTANT ADVANTAGES*

1. **EASY TO USE**—applied by brush at the original consistency without dragging.
2. **FAST SETTING**—sets fast and dries quickly to a strong continuous film.
3. **NON-HAZARDOUS**—aqueous resin emulsion base.
4. **FLAME-RESISTANT FILM**—dry film does not support combustion.
5. **RESISTANT TO MOISTURE, OILS AND FATS.**
6. **RESISTANT TO MOLD AND VERMIN ATTACK.**
7. **GOOD UNDERCOATING FOR PAINT**—no detrimental effect on subsequent coatings of paint ordinarily used.
8. **ADHESIVE PROPERTIES**—good adhesion between insulating material and lagging cloth.
9. **FLEXIBILITY**—tends not to become brittle on aging or peel off at usual temperatures.
10. **SAVES PAINT**—acts as a primer for paints and retards their penetration into the lagging cloth.
11. **UNIFORM**—close control of raw materials and processing.
12. **MEETS ACCEPTED SPECIFICATIONS**—for shipbuilding, process piping, heating, etc.



Swift's Lagging Adhesive is used exclusively throughout this multi-million dollar processing plant.

The best way to prove the superiority of Swift's Lagging Adhesive is by means of a trial order. Use the coupon at the right to order a 5 or 10 gallon supply at the quantity price.

Swift 101 ST YEAR

To Serve Your Industry Better

with these Adhesive Products

RESINS AND RUBBERS IN EMULSION OR SOLVENT • INDUSTRIAL BONDING COMPOUNDS • DRY, LIQUID AND FLEXIBLE ANIMAL GLUES • LIQUID DEXTRIN ADHESIVES

USE THIS COUPON FOR FURTHER INFORMATION

Swift & Company HP-116
Adhesive Products Department
Chicago 9, Illinois

Please send me your .... gallon introductory trial shipment of Swift's Lagging Adhesive at the quantity price, to be tested for use in our operations. We understand, if not fully satisfactory, it may be returned for credit at your expense.

Name .....

Firm Name .....

Address .....

City ..... Zone ... State .....

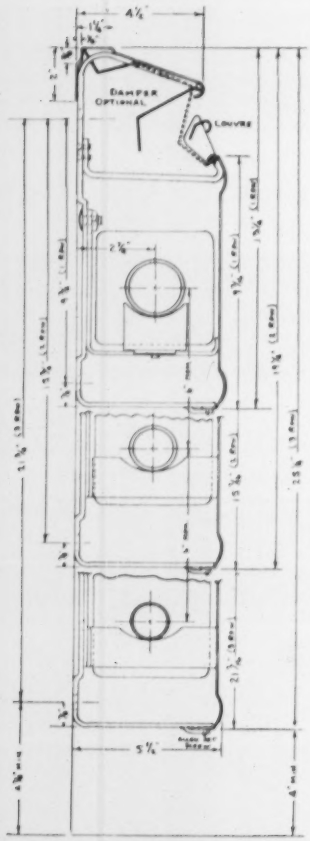
This offer expires January 31, 1957.

New! VULCAN LINO-TRIM
COMMERCIAL ENCLOSURE

STYLED FOR BEAUTY
DESIGNED FOR HIGH OUTPUT

APPLICATIONS

The perfect choice for modern architecture, including schools, hospitals, churches and office buildings.



Note: Available with Rigid or Slide Cradle Hangers. The same enclosure can be used with 3¼" and 4¼" fins.

FEATURES AND ADVANTAGES

- Design simulates Vulcan's famous TRIMLINE Baseboard, particularly suited to modern and progressive architecture.
- Designed for high output, wide flexibility. Available in 1-, 2- and 3-high.
- Front easily removed for cleaning and access to piping. Top permanently anchored to wall with pre-formed caulking groove to prevent air leakage — eliminates periodic removal and subsequent damage to wall finish.
- Attractive, fixed louvre.
- Enclosure can be easily cut to length on the job.
- Permanently anchored, extra heavy steel support brackets hold cover rigidly, top and bottom.
- Full line of matching accessories.

SPECIFICATIONS

LENGTHS — Available in stock lengths up to 8′ in 6″ increments.

DAMPERS — furnished in same length as enclosures; packed separately and easily installed in field without screws. Snaps into place.

MATERIAL — 18 gage, zinc-coated, rust-resistant, bonderized steel. (16 gage also available.)

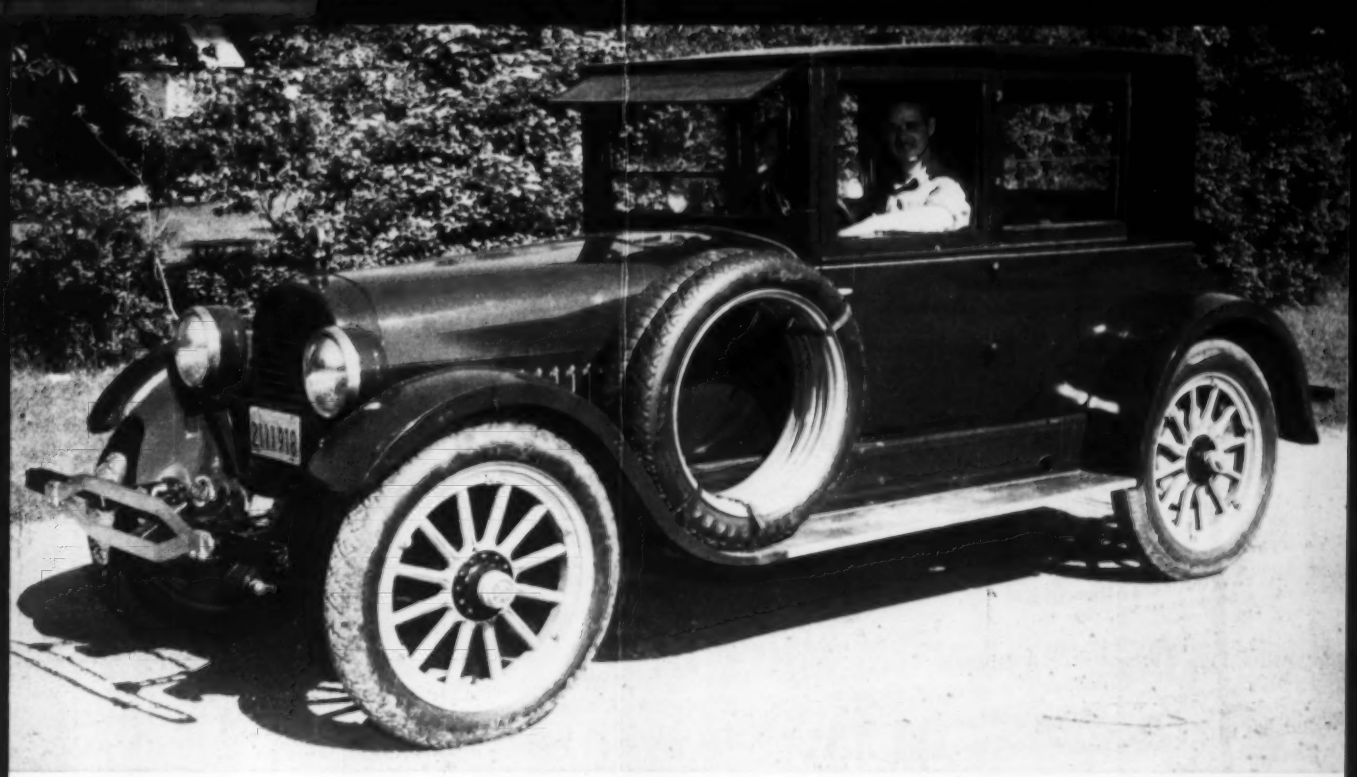
RATINGS

Complete ratings available. Write today for Catalog 625B.

THE VULCAN RADIATOR CO.

775 CAPITOL AVE., HARTFORD 6, CONN.

Originators of Fin-Tube and Baseboard Radiation in America



Does the guy still drive a 1930 auto?

What prompted this question was the third request in four days for repair parts for one of our good old 1930 boiler feeders . . . along with a nice letter telling us how it has served for all those 26 years.

Thanks for those kind words, friend contractor, but tell us: Hasn't that 1930 feeder earned retirement? Does its owner still drive a 1930 automobile?

We'll bet the owner of that feeder has had at least eight fancy motor cars in the past 25 years, and nearly as many refrigerators, dishwashers, toasters and other flashy automatic gadgets. But down in his basement, safely hidden from the scorn of his neighbors, is an assortment of heating equipment that would probably put an antique museum to shame!

Well, we realize that auto makers have a smart way of obsoleting their models almost before the paint is dry. But we're not suggesting *that* kind of pressure; we're just saying sell 'em a new one *when* they need it.

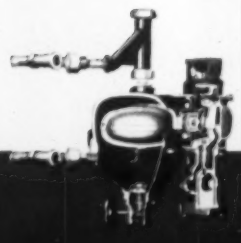
The owner of that 1930 feeder probably needs, not only a new feeder, but a whole new heating plant to go with it. You have people like him in your locality. Tell 'em and sell 'em what they need . . . NEW, doggone it, NEW! It's all right to "make '56 the year to fix," but let's not forget that

the best way to fix is to REPLACE!

McDonnell & Miller, *Inc.* 3500 N. Spaulding Ave., Chicago 18, Ill.

Doing One M&M *Thing Well*

Strictly 1956 Models!



No. 47-2 *Feeder and Cut-off Combination*—for most automatically fired heating boilers operating at pressures up to 25 psi. Other types for larger boilers, higher pressures.

No. 150 *Pump Control, Cut-off, and Alarm Switch*—for boilers up to 150 psi. Also available with integral water column (No. 157). Other types for pressures up to 250 psi.

No. 67 *Low Water Cut-offs*—for all steam boilers with pressures up to 20 psi. Other types for hot water heating boilers, higher operating pressures.

230 Series *Btu-rated Pressure Relief Valves*—for hot water space heating boilers. Complies with ASME Boiler Code in every way; rated and certified by National Board.

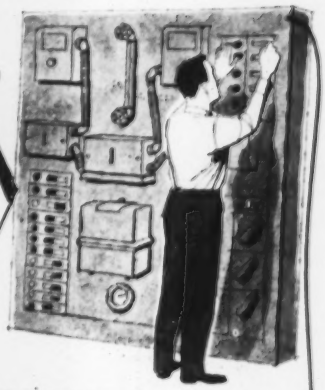
McDONNELL *Boiler Water Level Controls*

Bayley

FAN-A-GRAFICS

For Equipment Engineers

When You Push the Button . . .



ACTION BEGINS THROUGHOUT YOUR FAN SYSTEM

Even the best fan, properly installed, will provide smooth, efficient operation only when matched to the external system, with special attention to the following:

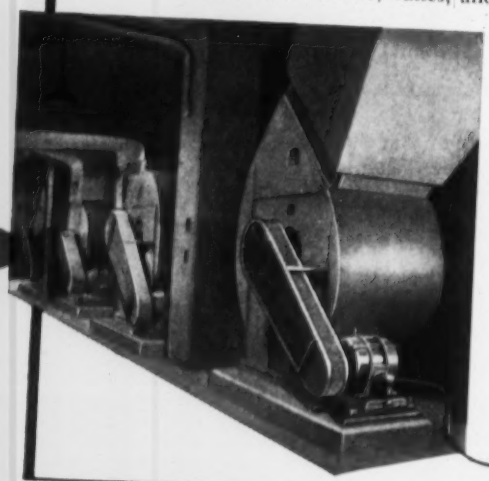
★ **DRIVE & RUNNING GEAR:** Check for correct wheel rotation, bearings running free and properly lubricated, belts or couplings accurately aligned and tight.

★ **MOTOR & STARTER:** See that protective devices are installed and in proper working order, motor not overloaded, controls functioning as desired.

★ **FAN SPEED:** R.P.M. should be measured and verified with name-plate data or written specifications.

★ **PRESSURE & VOLUME:** Take readings at essential points in system with manometer, pitot tube, velometer, anemometer, according to requirements.

★ **BALANCING SYSTEM:** Achieve required space conditions by means of adjustments provided in dampers, diffusers, vanes, and other system-control apparatus.



★ **PULSATION & VIBRATION:** Not necessarily fault of the fan; investigate mounting, supports, motor and drive balance, then recheck system and fan operating conditions.

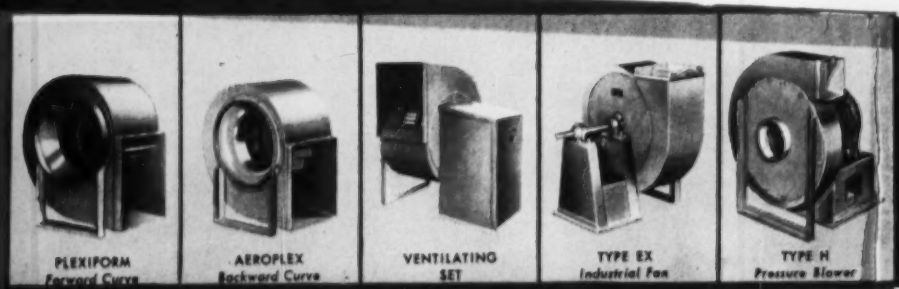
★ **DUCTWORK:** Good workmanship is important. Noise or excessive losses may be due to loose joints, rough surfaces, improper bends, inadequate bracing.

★ **FINAL CHECK:** All appurtenances in place and adjusted, leaks or other defects corrected, foreign objects or materials removed.

NOW YOU'RE READY TO RUN! .....

—with the added assurance of dependable performance when your air-handling equipment is furnished by BAYLEY.

Our engineering staff is at your disposal

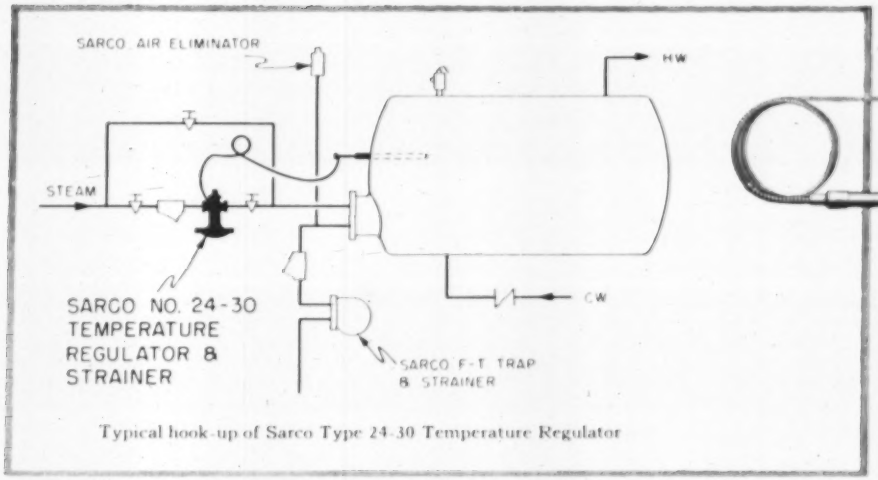


Engineered

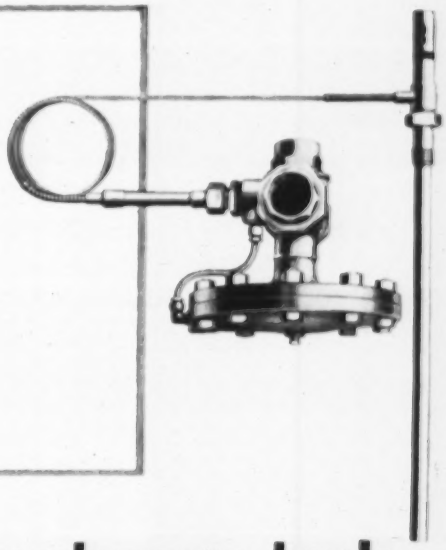
AIR HANDLING EQUIPMENT

BAYLEY BLOWER COMPANY

6600 W. BURNHAM
MILWAUKEE, WISCONSIN



Typical hook-up of Sarco Type 24-30 Temperature Regulator



HOT WATER...in your storage tank

...when you want it...*and at minimum cost!*

That's the performance you get when this Sarco Temperature Regulator stands guard on your water heater.

With fuel representing about 50% of your total direct power costs, it's important that you *get hot water at lowest cost per wash.*

Here's how the Sarco 24-30 Temperature Regulator does the job:

NO OVERHEATING – during periods of no draw-off. The single seated valve shuts tight, prevents creeping of temperature.

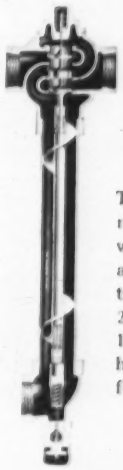
LOW INSTALLATION COST – the T R 24-30 is self-contained and self-operated, no need to install compressed air or electric lines.

CLOSE TEMPERATURE CONTROL – thermostat actuates internal pilot valve which immediately opens or closes main valve.

LOW-MAINTENANCE PACKLESS SEALS – trouble-free design eliminates stuffing boxes, no repacking, no sticking or leakage of exposed valve stems.

WIDE RANGE OF ADJUSTMENT – you can adjust this temperature regulator 25° higher or lower than the temperature setting.

So, if you're not satisfied with your hot water service, call your local Sarco representative or write for Bulletin Sarco Company, Inc., Empire State Bldg., New York 1, N. Y.



Need Tempered Water ?

This Sarco Water Blender automatically mixes hot and cold water, delivers blended water at any desired temperature. Factory set for any temperature to 200° F., is easily adjusted to 15° F. lower and up to 40° F. higher than factory setting. Ask for Bulletin 800.

SARCO

SAVES STEAM

improves product quality and output

2046-B

Only Sarco Makes All 5 Types

That's why Sarco can give impartial advice on proper steam trap selection.

Thermodynamic Steam Traps

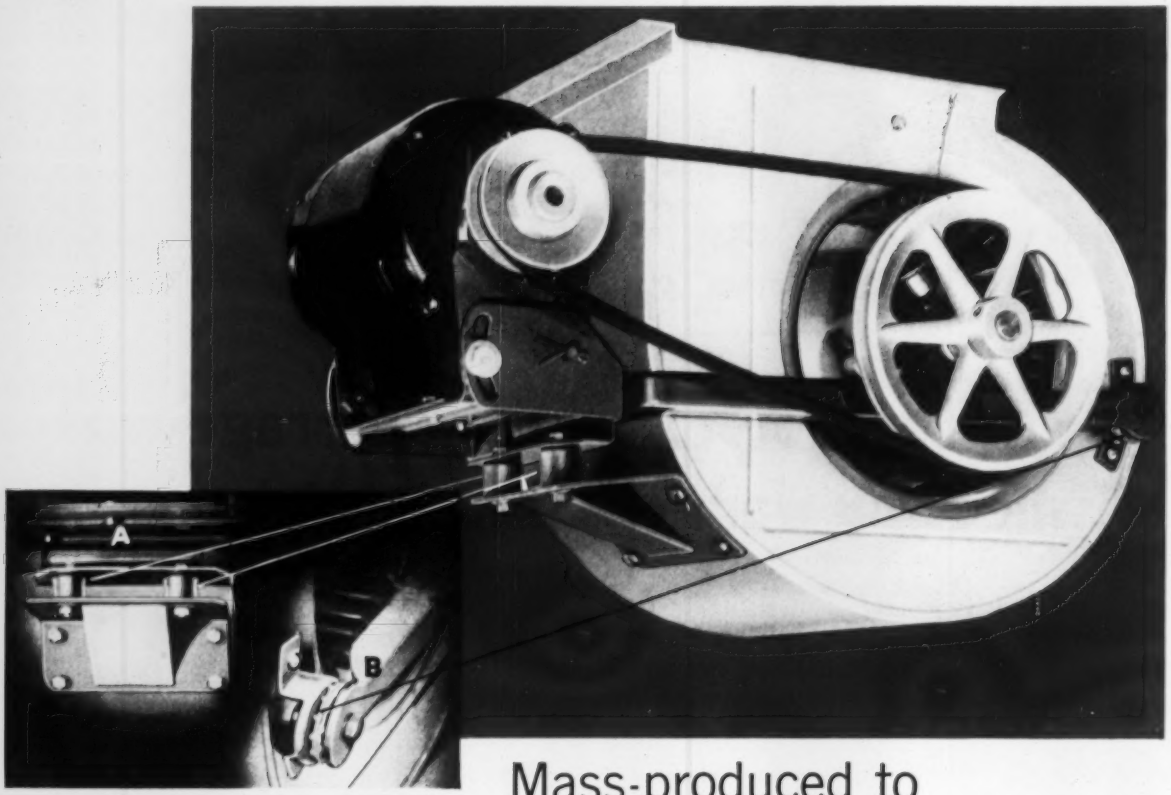
Thermostatic Steam Traps

Float Thermostatic Steam Traps

Liquid Expansion Steam Traps

Camlift Bucket Steam Traps

ENGINEERED RUBBER PRODUCTS



Mass-produced to exacting specifications

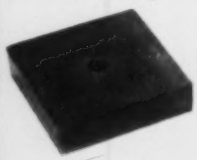
U. S. Rubber Molded Mountings and Connectors help keep blowers operating at "whisper silence".

A well-adjusted system for a forced warm air furnace requires that all vibration and noise be kept to an absolute minimum. In this leading "sulky" type blower, the entire moving parts assembly floats on a cushion of U. S. Molded Rubber Mounts (A) and firm, but movement-free, U. S. Rubber Finger-Flex Connectors (B). In this manner, all mechanical vibrations are isolated—the blower operates in silence.

U. S. Rubber Molded Mountings and Connectors were selected because of their ability to retain "molded in" shape during their entire long life and for the economy they provide.

Yet, this is only one of hundreds of applications wherein U. S. Engineered Rubber Products *do jobs no other material can do.* "U. S." engineers will help you solve any molded rubber problem. Contact us at Rockefeller Center, New York 20, N. Y. In Canada, Dominion Rubber Co., Ltd.

U. S. Molded Shock Mounting for shock absorption when shipping delicate instruments. An electric typewriter manufacturer, for instance, has cut down shipping damage to ½% and cut packaging costs considerably. Improved rubber-to-metal bonding permits their re-use.



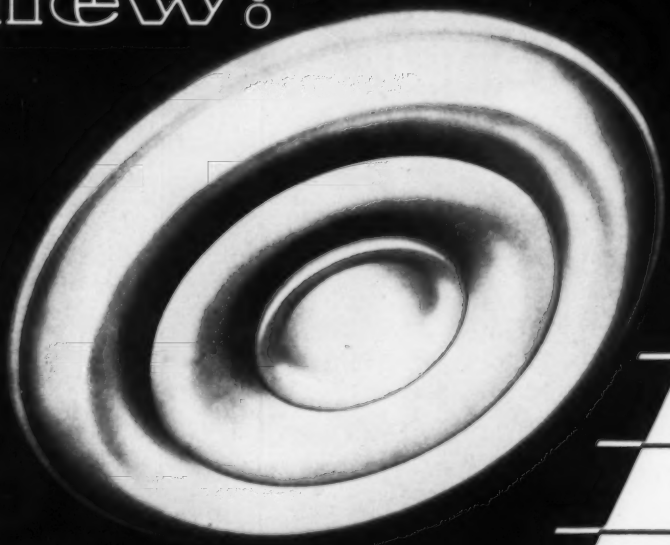
U. S. Molded Drop Forge Mounting in service for over 13 years—absorbed *80 million* blows of almost 1600 lbs. force each without wearing out—removed only when steel retaining pins had corroded.

U. S. Molded Diaphragm for controlling liquid flow through motor valves. Offers high burst resistance, retention of molded shape under high pressures, and exact fabric placement.

Mechanical Goods Division

United States Rubber

new!



MODEL T-1

. . . the industry's first low-cost "adjustable-in-the-field" ceiling diffuser

NEW!

CURVED CONTOUR cone design provides air diffusion efficiency never before equalled—AT SUCH AN ECONOMICAL PRICE.

NEW!

Unsurpassed beauty . . . the ultimate in modern day design.

NEW!

Easiest . . . fastest in the world to install—adjust.

●

The T-1 diffuser is only one Model of Titus' exciting completely new line of CEILING DIFFUSERS AND ACCESSORIES. If you haven't received literature on this new line—WRITE TODAY!

designed by TITUS

Fills a long-standing need in the air conditioning field! The new Model T-1 is the first diffuser made that COMBINES the top quality features, attractive styling and high diffusion efficiency of much more costly units—WITH TRULY MODEST PRICING.

This 3-cone diffuser is simplest of all to install, adjust. Inner cone assembly quickly, easily removed—snaps back into position. Adjustable—on the job—to 2 different air patterns by simply changing screws on inner assembly.

Rugged steel construction. Beautiful aluminum finish. For exposed duct or flush mounting. Each diffuser individually packaged in damage-proof carton

MAIL COUPON TODAY FOR FREE LITERATURE

TITUS MFG. CORP., Waterloo, Iowa

Gentlemen: Rush me complete details on your new economy line of MODEL T-1 CEILING DIFFUSERS that give BIG performance at a BIG savings in cost.

Name _____

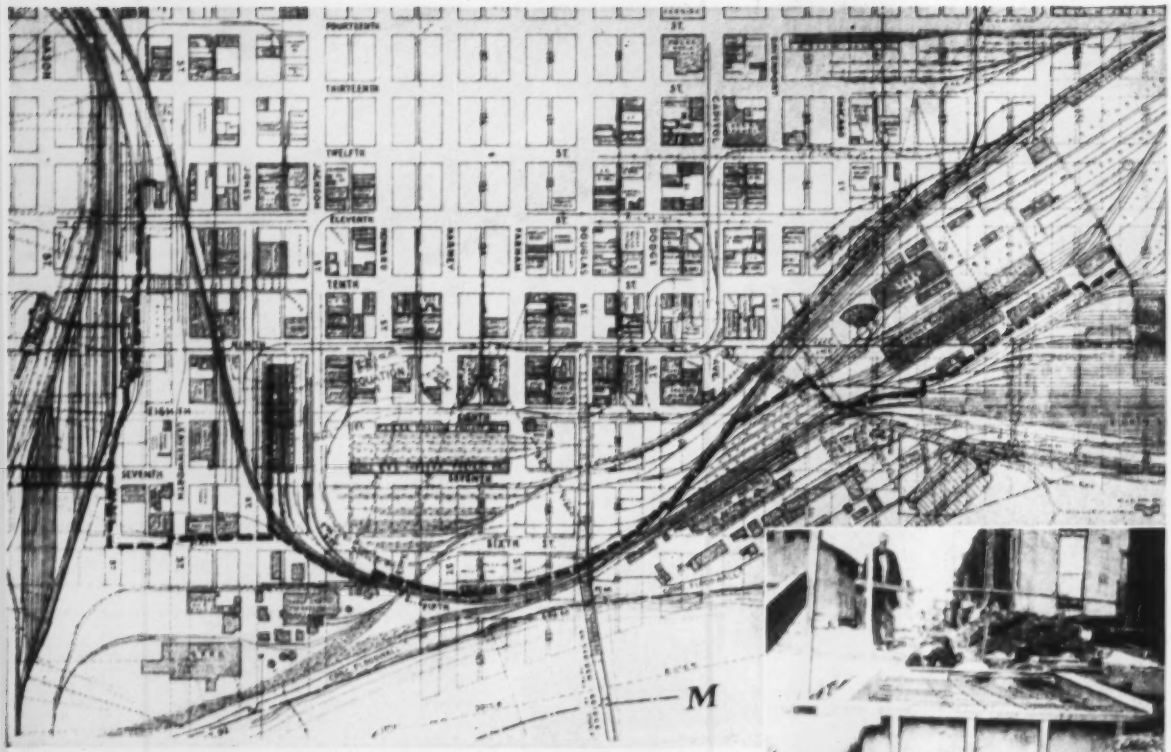
Company _____

Address _____

City _____ State _____

TITUS CEILING DIFFUSERS

. . . HANDLE OVERHEAD AIR *Gracefully* WITH PRECISION



Union Pacific installation (heavy dotted line) runs under pavement to various shops and buildings. Gilsulate has high load-bearing capacity, takes heavy pounding here.

9250 ft. of GILSULATE®-covered steam lines help Union Pacific run smoothly in Omaha

Under tracks, alongside of tracks, under heavily-trafficked streets—practically all types of tough in-service conditions have been overcome by GILSULATE at Union Pacific Railroad's Omaha installation. Running from the main boiler room of the UP shops to the Union Station, the distribution system consists of three sections: 1) a 2800-foot section of 8-inch steam line; 2) 5300 feet of 8-inch steam and a 4-inch diesel oil line; 3) 1150 feet of 3-inch steam line branching from section (2) and carrying 150 psi steam plus 100 degrees superheat.

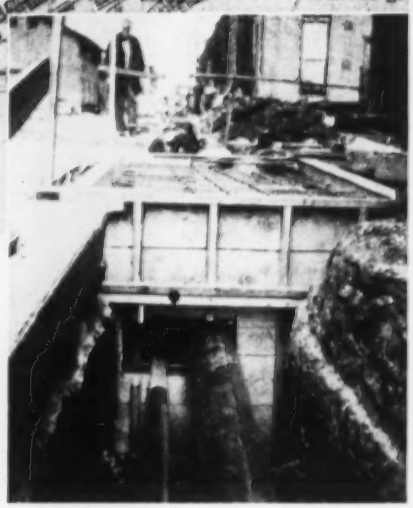
First installed in 1954 and continually subjected to pounding, shock and vibration from heavily-loaded freight trains and normal yard traffic, this GILSULATE system has functioned flawlessly. 810 tons of Type C GILSULATE were used initially, and additional installations are being made here and at other Union Pacific yards.

GILSULATE's insulating efficiency, all-around pipe protection, and high loading capacity make it the ideal choice for this and other types of installations. More and more, architects, engineers and contractors are discovering that GILSULATE provides permanent corrosion protection for hot underground pipes at the lowest cost per installed linear foot of any other pipe insulation system.

Investigate the value of low-cost, easily-installed, dependable GILSULATE. See your local GILSULATE distributor for a convincing demonstration. Complete details are yours for the asking. Write the office nearest you.

AMERICAN GILSONITE COMPANY
SALT LAKE CITY 1, UTAH

Affiliate of Barber Oil Corp. & Standard Oil Co. of Cal. OFFICES AT 134-B West Broadway, Salt Lake City, Utah 1145 East Jersey Street, Elizabeth 4, New Jersey
The Agency Building, 3537 Lee Road, Cleveland 20, O.



An 8-inch steam and 4-inch diesel line entering a bellows-type expansion joint in a manhole; system was installed by UP crews.

FACTS ABOUT GILSULATE

1. **EASY TO USE**—just pour and tamp...pipe heat does the rest.
2. **FORMS 3 ZONES** of protection against heat loss and all hazards commonly encountered by hot buried pipes.
3. **NEEDS NO HOUSING OR MECHANICAL SHEATHS:** no mixing, special handling or equipment.
4. **ONLY NEEDS NORMAL PIPE SPACING:** for multiple pipe or cramped conditions.
5. **THREE TYPES AVAILABLE:**
   Type A for 220°-300°F. temp. range
   Type B for 300°-385°F. temp. range
   Type C for 385°-520°F. temp. range

GILSULATE®
The Triple-Zone Insulation System For Lifetime Protection of Hot Underground Pipes

STRUTHERS WELLS PRODUCTS

•

BOILER DIVISION

BOILERS for Power and Heat
High and Low Pressure
Water Tube . . . Fire Tube
Package Units

PROCESSING EQUIPMENT DIVISION

Crystallizers
Direct Fired Heaters
Evaporators
Heat Exchangers
Mixing and Blending Units
Quick Opening Doors
Special Carbon and Alloy Processing Vessels
Synthesis Converters

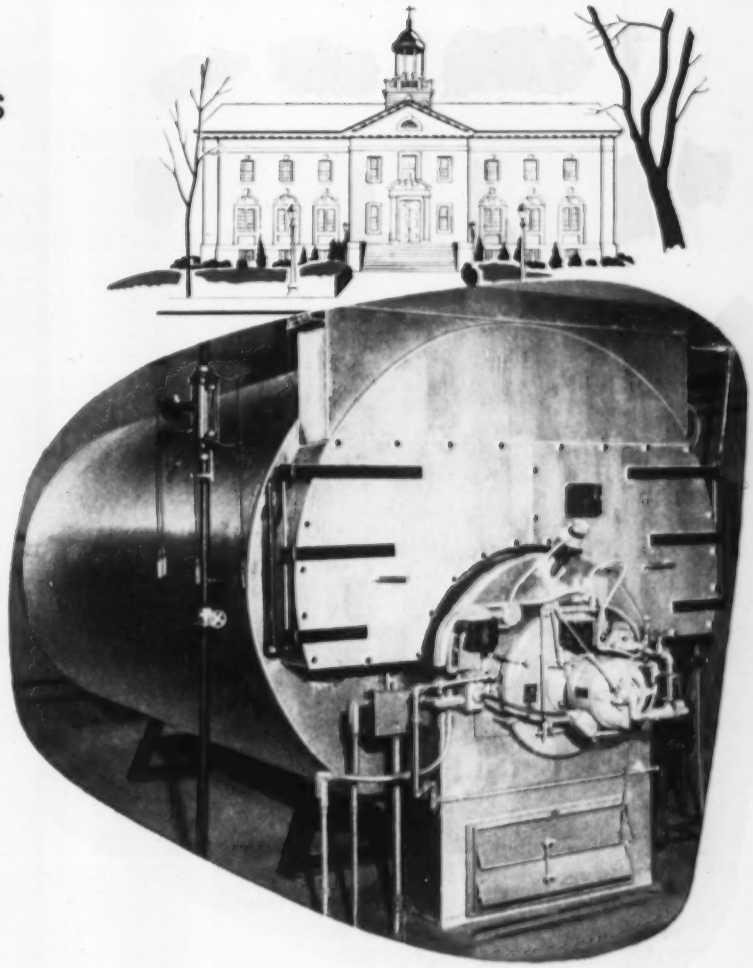
FORGE DIVISION

Crankshafts . . . Pressure Vessels
Hydraulic Cylinders
Shafting . . . Straightening and Back-up Rolls

MACHINERY DIVISION

MACHINERY for Sheet and Structural Metal Forming
Tangent Benders
Folding Machines
Roller Table and Tumble Die Bending Machines
Press Brakes
Punching and Notching Machines
Forming Dies

THE TITUSVILLE IRON WORKS COMPANY
A Division of
Struthers Wells
TITUSVILLE, PENNSYLVANIA
Manufacturers of A COMPLETE LINE OF BOILERS FOR EVERY HEATING AND POWER REQUIREMENT
PLANTS AT TITUSVILLE, PA. AND WARREN, PA.
Offices in Principal Cities



Keeps Gym Comfortable—
Never works up a sweat!

TITUSVILLE
Scotch Marine Heating Boilers

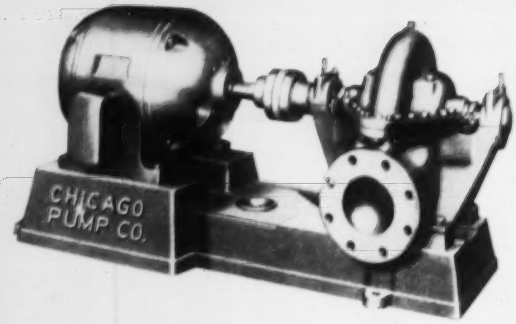
Chosen for its dependable quick steaming quality, compactness and low headroom, this Titusville SOH-242 Boiler easily handles the heating requirements of Dickinson College's gymnasium and several nearby buildings on the campus at Carlisle, Pa. ● Let us detail the Scotch Marine economy advantages for your own applications—Write!

Heating Contractors: H. B. McClure Company, Harrisburg, Pa. Engineers: Whitman, Requardt & Assoc., Baltimore, Md.

FROM *Chicago*

TOP QUALITY PUMPS

Engineered for plumbing, heating, and air conditioning systems

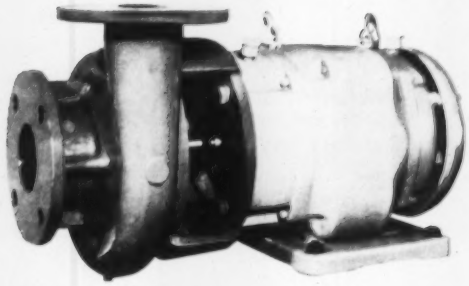


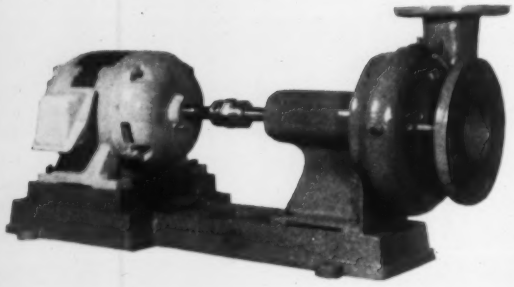
TYPE D DOUBLE SUCTION HORIZONTALLY SPLIT CASE PUMP

A rugged, heavy-duty pump that guarantees long, trouble-free service. The rotating assembly may be inspected without disconnecting the piping. Capacities up to 1900 G.P.M. Heads to 530 Ft. Described in Bulletin 101.

TYPE CC CLOSE COUPLED PUMP

Handles the toughest pumping jobs efficiently and in the least possible space. May be mounted in any position as long as the motor is not lower than the pump. Equipped with leak-proof mechanical seal. Capacities up to 500 G.P.M. Heads to 215 Ft. Described in Bulletin 108.





TYPE FC PEDESTAL MOUNTED FLEXIBLE COUPLED PUMP

Like the CC, all FC pumps are equipped with the most reliable mechanical seal ever built into a pump. Ceramic-faced stationary seat is highly resistant to wear. Accurately lapped surfaces and automatic adjustment for wear assures long life under strenuous service. Described in Bulletin 107.

For trouble-free, "worry-proof," efficient pumping at all times — specify Chicago Pumps. Write for complete information.

fmc

CHICAGO PUMP COMPANY

Subsidiary of Food Machinery and Chemical Corporation

BUILDING PUMP DIVISION

400 DIVERSEY PARKWAY • CHICAGO 14, ILLINOIS

Cande-Vac ®, Sure Return ®, AVC, LVC, Fire, House & Circulating Pumps, Pneumatic & Tankless Water Systems, Flush Kleen ® Sewage Ejectors, Little Giant ® & Non-Clog Bilge Pumps. Pumps for every industrial use

THESE MIDWEST "LONG TANGENT" ELBOWS SAVED $4121 IN PIPE

MIDWEST "LONG TANGENT" ELBOWS COST NO MORE THAN OTHER ELBOWS

Here are 1227 Midwest "Long Tangent" Elbows (12", 14" and 16" standard weight) ready for shipment to a chemical plant. Each Midwest "Long Tangent" Elbow has a straight section on each end equal in length to ¼ the nominal pipe size. Thus a 12" elbow saves 6" of 12" pipe while a 16" elbow saves 8" of 16" pipe. It doesn't take long to save a lot of pipe and a lot of money . . . in this instance $4121.

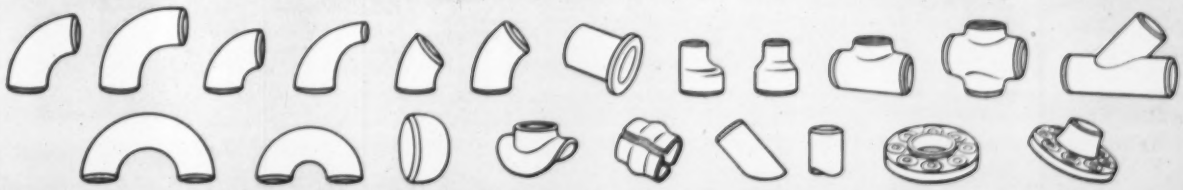
But saving pipe is not the only advantage of Midwest "Long Tangent" Elbows. They often eliminate short nipples and their extra welds . . . save time and money in lining up and clamping pipe and fittings . . . slip-on flanges are more easily applied. For all the facts, write for Catalog 54.

MIDWEST PIPING COMPANY, INC.
Main Office: 1450 South Second Street, St. Louis 4, Mo.
Plants: St. Louis, Clifton, N.J. and Los Angeles

Sales Offices
New York 7—50 Church St. • Chicago 3—79 West Monroe St.
Boston 27—426 First St. • Los Angeles 33—520 Anderson St.
Houston 2—1213 Capitol Ave. • Tulsa 3—224 Wright Bldg.
Cleveland 14—616 St. Clair Ave. • Miami 34—2103 Le Jeune Rd.
San Francisco 11—420 Market St. • Oneida, N. Y.
STOCKING DISTRIBUTORS IN PRINCIPAL CITIES

MIDWEST WELDING FITTINGS

MIDWEST WELDING FITTINGS Improve Piping Design and Reduce Costs



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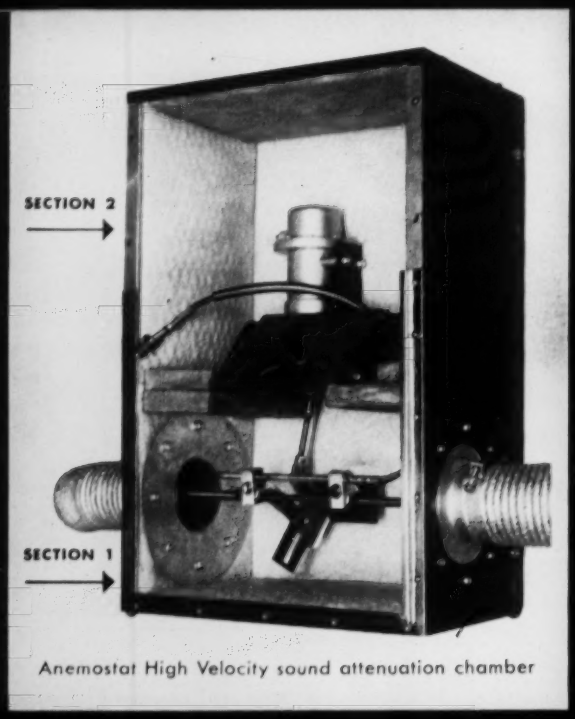
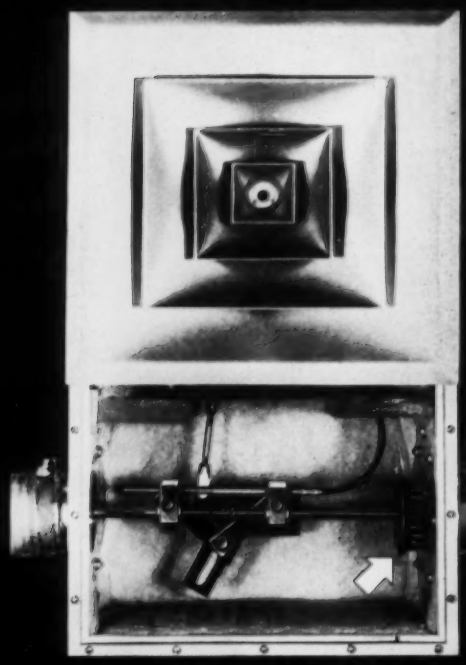
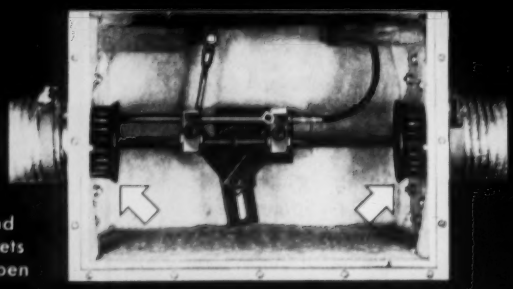


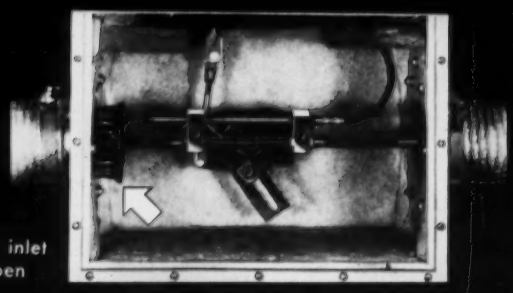
Anemostat High Velocity sound attenuation chamber



Hot inlet open in Section 1.
Anemostat in place covers Section 2



Hot and cold inlets 50% open



Cold inlet open

How to mix and diffuse high velocity air automatically

The Anemostat High Velocity sound attenuation chamber is divided into two sections. Both hot and cold air from the main risers enter Section 1, which is an acoustically lined blending chamber, in which the volumes of air are controlled by the Anemostat serrated rocket-socket valves. When the thermostat is set, the rocket-socket valves move slowly back and forth, thereby adjusting the volume of air supplied through the hot and cold inlets. The velocity of the air which enters Section 1, at from 3500 to 6000 fpm, is automatically reduced by expansion.

As the blended air meets the temperature requirements of the thermostat, it passes through a baffle arrangement into the acoustically lined Section 2 of the chamber, further reducing the db rating of the air.

The air then passes through the Anemostat Air Diffusers, where the aspiration effect causes mixing of room and supply air within the diffuser, resulting in further temperature equalization. The diffuser then delivers to the occupants of the room draft-free air at the desired temperature.

The Anemostat All-Air High Velocity distribution system offers other important advantages. It can be used with smaller than conventional ducts. It can be installed faster and at less cost. It requires no coils, thus eliminates leakage, clogging and odors. Furthermore, Anemostat round, square and straightline diffusers with high velocity units blend into a wide variety of architectural designs.

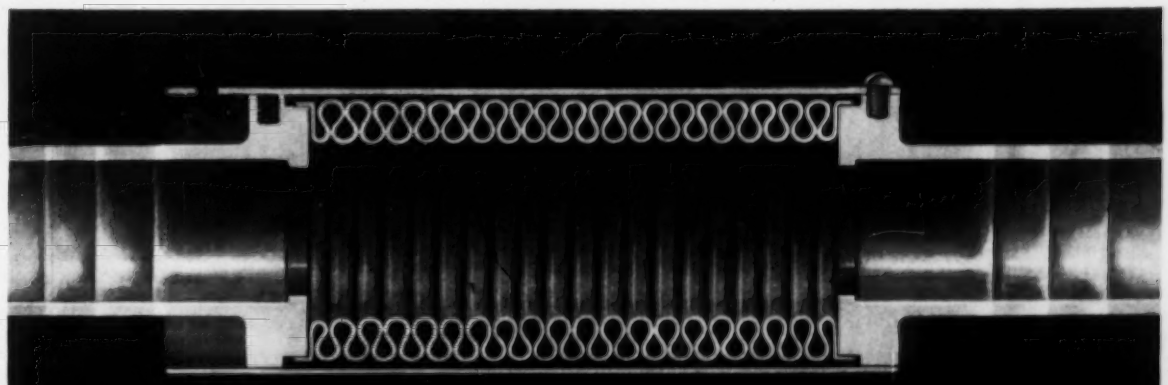
Write for 1956 New Products Bulletin and Selection Manual 50 to Anemostat Corporation of America, 10 E. 39 Street, New York 16, N. Y.

Anemostat: The Pioneer of All-Air High Velocity Systems

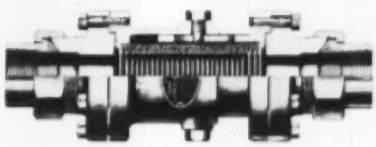
G-1997

ABSORB PIPE LINE EXPANSION

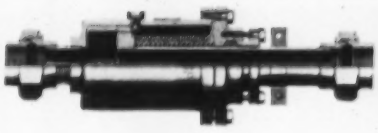
this trouble-free way



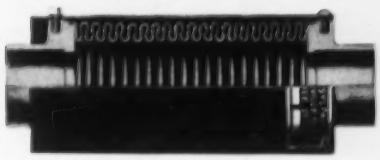
In absorbing the linear movement of steam and water lines, no method is more fool-proof and economical than the Fulton Sylphon Packless Expansion Joint. These Joints minimize installation and construction costs, eliminate packing maintenance, and maintain vacuum for economical heating. The reason is their exclusive Sylphon® bellows. With its two-ply *seamless* construction, this bellows gives utmost protection against leakage . . . Produced by cold-working, it also has greater resiliency for years of "stretching and squeezing."



STEAM LINES No. 110-M Packless Expansion Joint absorbs expansion up to 1¼" in horizontal or vertical lines. Bellows made of Monel for extra strength and corrosion-resistance. Sizes 1" through 3". Steam or water pressures up to 100 psig. for some sizes.



WATER LINES No. 111-M Packless Expansion Joint allows for 1¼" expansion or contraction in hot water or chilled water lines. Features strong, corrosion-resistant Monel bellows plus emergency packing. Pressures to 100 psig, sizes ¾" through 3".



STEAM OR WATER No. 96066 is simple, compact. Absorbs expansion of "baseboard" radiation, finned connectors, horizontal or vertical supply lines, etc. ½" expansion capacity. Maximum pressure 40 psig, copper pipe sizes ¾" through 2".

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CONTROLS COMPANY

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HAYES counter flow furnaces were designed for better control of slab temperatures plus required ventilation, and efficiently handle the large air flow rates used on air heated floor applications. For further information request bulletin or inquire through HAYES representatives in all principal cities.

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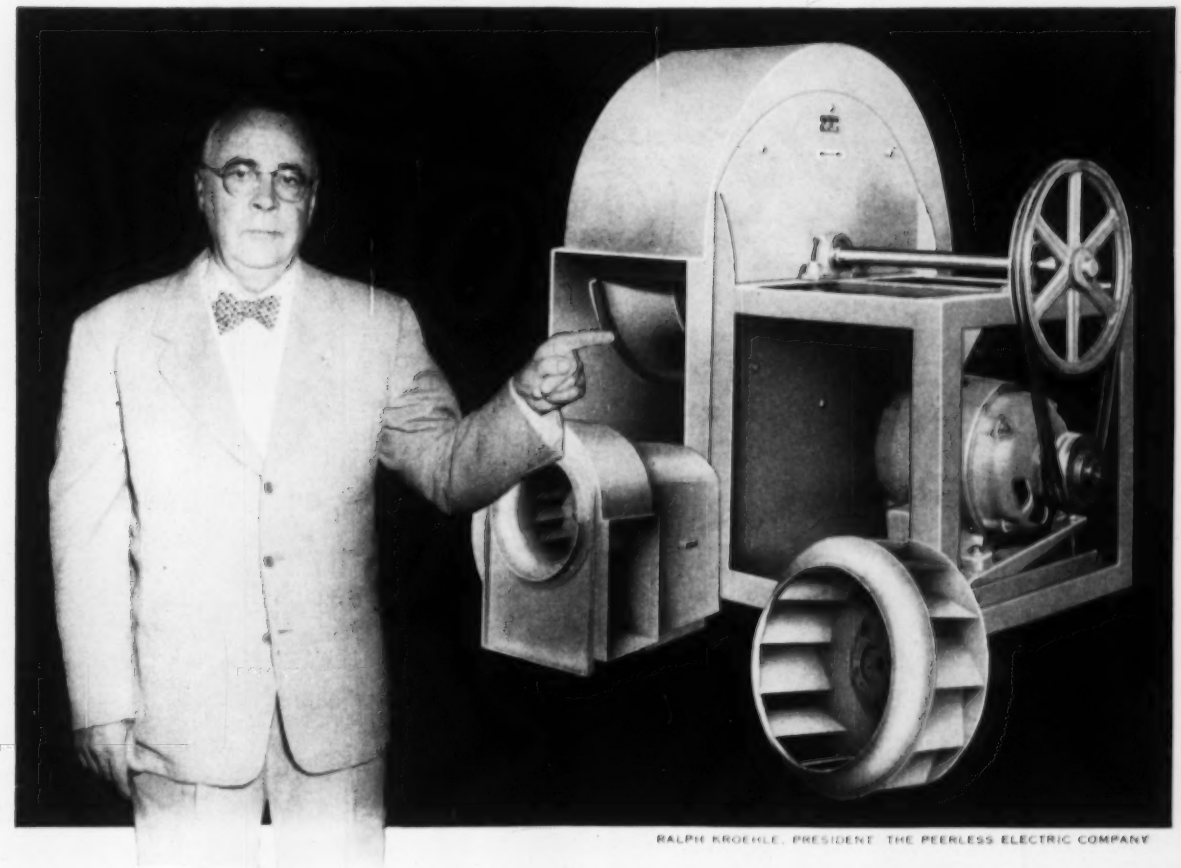

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● Peerless engineers work under orders to give every fan and blower "the best possible engineering." Our engineering standards now meet or exceed all industry codes. The reason is simple.

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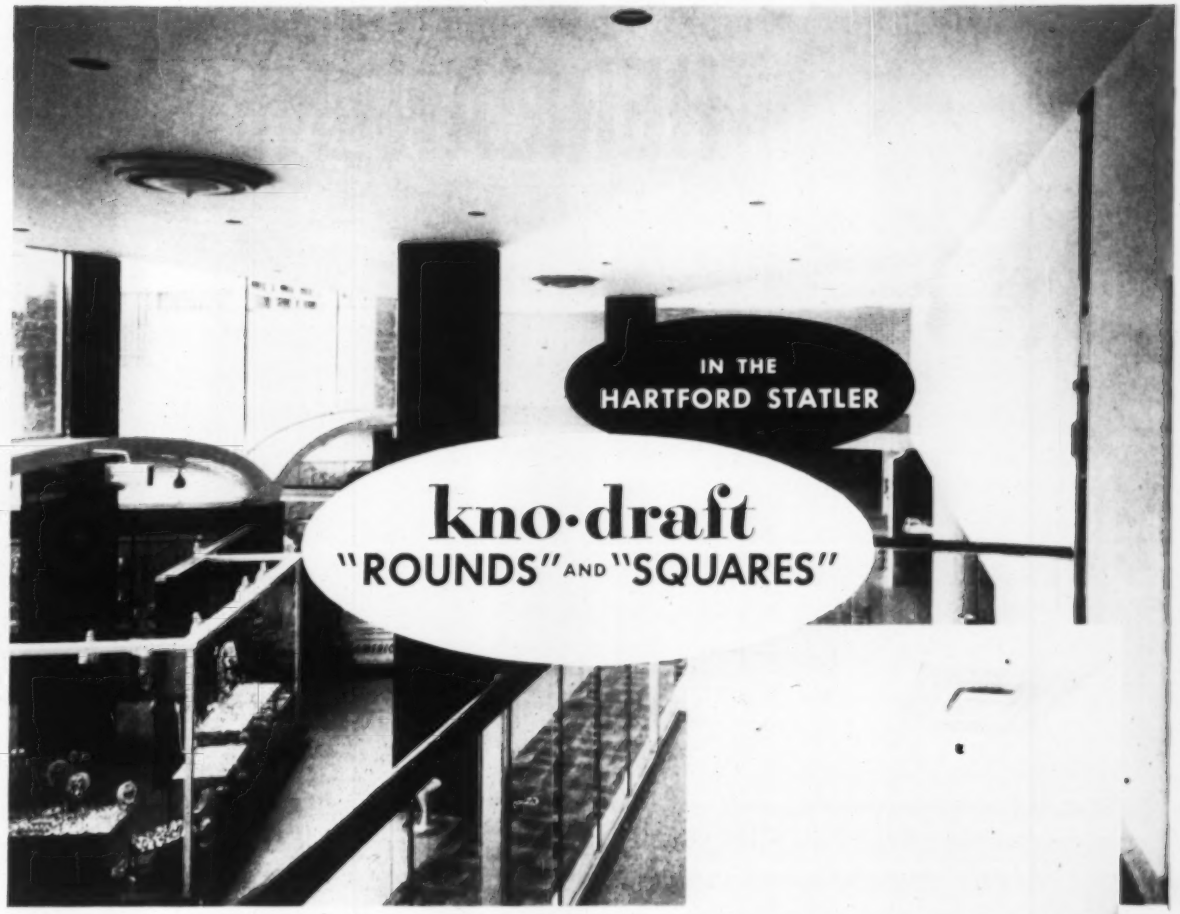

Engineers: Jaros, Baum and Bolles
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Conditioned air is delivered to all offices and public rooms of the new, modern Statler Hotel in Hartford, Connecticut, through Kno-Draft Adjustable Air Diffusers. Both round and square units are used—and a few of the new slot-type Kno-Drafts (not shown).

Primary reason for selection of Kno-Draft was the greater comfort assured by *draftless* air movement, uniform temperature, and the easy and accurate control of both air volume and flow pattern.

And notice how neatly the Kno-Draft squares fit into acoustical ceilings and how—square or round—the handsome Kno-Draft units blend unobtrusively with the architectural scheme of things.

For complete specifications, engineering and installation information on Kno-Draft round, square and slot-type diffusers, simply write on your letterhead to Connor Engineering Corporation, Dept. G-116, Danbury, Conn.

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adjustable air diffusers

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A Name Known For *Better Air* throughout half a century

OLD ENOUGH to have built a reputation for quality and dependability throughout half a century.

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BIG ENOUGH to offer one of the most complete lines in the industry, and a nation-wide service organization second to none.

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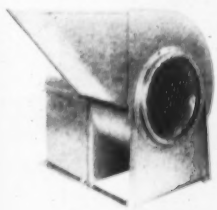
HORIZONTAL UNIT HEATER
Available in 18 sizes, designed for ceiling suspension and also to use either steam or hot water. Quiet operation; compact design. Catalog No. 700.

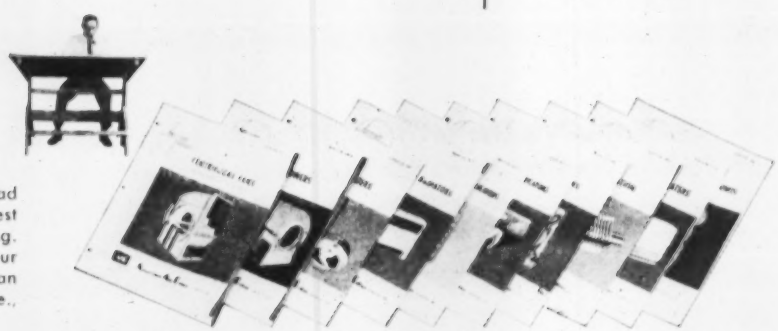
INDUSTRIAL HEATER
Replaces exhausted air, balances minus pressures. Big capacity—does the job of many smaller, propeller-type units. Catalog No. 750.



UNIT BLOWER
Years-ahead features in new "packaged" Unit Blowers. Compact, space-saving, easy to service. Wide range of unit sizes. Catalog No. 826.

A wealth of useful data now ready for you in the NEW HERMAN NELSON Catalogs

New, modern format . . . easy-to-read engineering catalogs that are the finest in the industry are yours for the asking. Request catalogs you need on your business letterhead. Address American Air Filter Co., Inc., 373 Central Ave., Louisville 8, Ky.



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VERTICAL UNIT HEATER

For high ceiling installations. Discharges air vertically downward or at angle to vertical in various directions. Steam or hot water. Catalog No. 700.

GAS-FIRED UNIT HEATER

Job-rated for stores, lobbies, studios, warehouses, offices, salesrooms—all efficient heating. Available in seven different sizes. Catalog No. 715.

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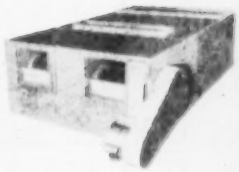
16 models—64 air inlet-outlet arrangements. Fully recessed, semi-recessed or free-standing applications. Smartly designed. Catalog No. 727.



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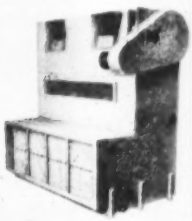
Hangs on ceiling, out of the way, or mounts on wall or floor. Quiet operation, slow speed, with completely cataloged fan sections. Catalog No. 775.



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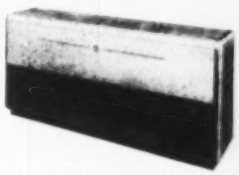
New type air-conditioning units for low cost commercial and industrial applications. Delivers up to 15,000 cu. ft. clean, cooled air per minute. Catalog No. 785.



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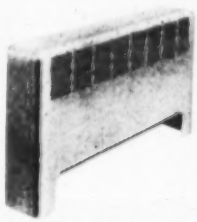

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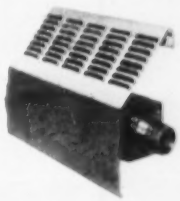

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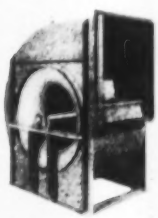
Available either with steel fins on steel tubing or aluminum fins on copper tubing. Light weight, suitable for exposed or concealed installation. Catalog No. 790.



CENTRIFUGAL FAN

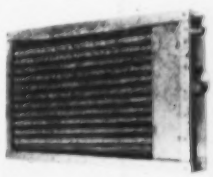
Available in either slow speed or non-overloading types; 17 wheel diameters from 12¼" to 73"; 8 arrangements for direct or belt drive. Catalog No. 850.

INDUSTRIAL EXHAUSTER

Exclusive hub assembly cuts maintenance & replacement costs. New impeller design; heavy duty shaft & bearings. Catalog No. 860.

PROPELLER FAN

Operates horizontally or vertically; belt or direct drive. Wide range of sizes in both types. Capacities to 36,150 CFM. Low operating cost. Catalog No. 800.



AEROFIN COILS

A complete line of steam, hot water, chilled water, direct expansion and special duty coils. Catalog No. 49-NF.

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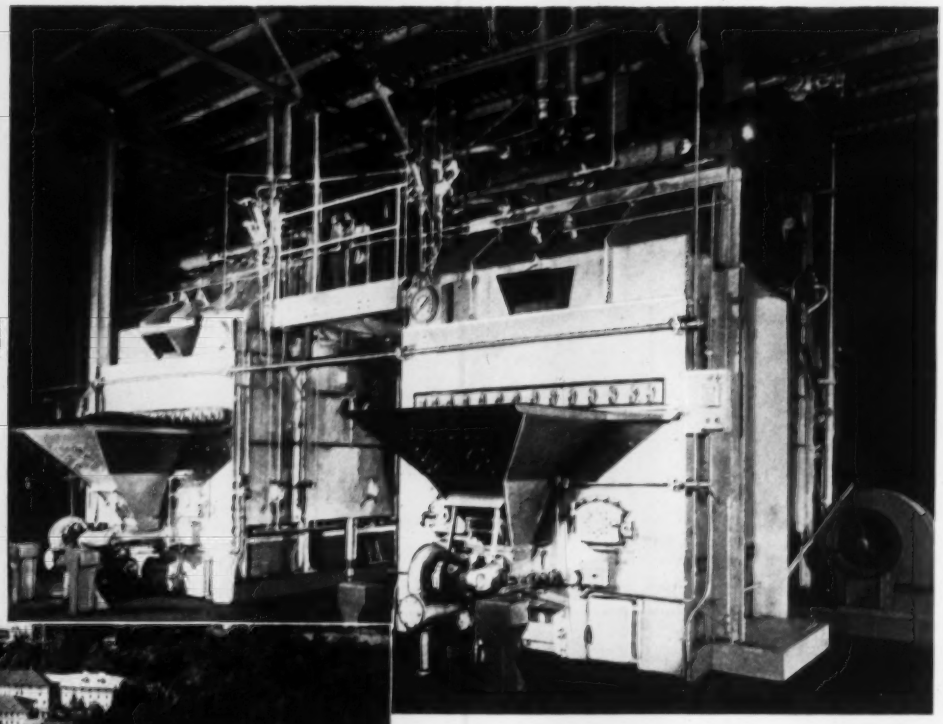


Each of the stoker-fired B&W Type FF Integral-Furnace Boilers at Pinehurst is designed to supply 17,000 lb of steam per hr. Wiley & Wilson of Richmond, Va., are the Consulting Engineers.

STEAM COSTS ⅓ LESS AT PINEHURST

Two B&W Boilers Help Cut Fuel and Other Plant Costs at North Carolina Resort

The need for a dependable steam supply that is also efficient and economical led Pinehurst, Inc. to install two coal-fired B&W FF Boilers in re-vamping its central steam plant. A famous winter resort, Pinehurst can't take chances with its steam supply. It must have as much steam as it needs, when and where it is needed. These new boilers replaced five older units to supply steam for all purposes to ten buildings, three of them hotels. In an emergency they provide steam for electric power generation.

By this modernization of its boiler plant, Pinehurst, Inc. gets more steam from less coal and at less cost. And, with automatic boiler controls, simplified coal- and ash-handling and substantially reduced maintenance, other costs have also been shaved.

If you use steam for power, processing or heating, be sure that your steam dollar is giving you full value. If you think it isn't, B&W will be glad to put 90 years of steam generation experience at your disposal, to help you modernize or expand your steam plant for important, long-term savings. Write, The Babcock & Wilcox Company, Boiler Division, 161 East 42nd Street, New York 17, N. Y.

BABCOCK & WILCOX

BOILER DIVISION

G-788

Yankee Stadium Club Gets Air Conditioning

. . . just before World Series

WELL OVER 100 tons of packaged air conditioning equipment was installed in the Stadium club for the benefit of the Yankee fans shortly before the World Series, according to the General Electric Co.

The Stadium club consists of five rooms at Yankee Stadium which cater solely to yearly boxholders and their guests. These rooms include one of the longest bars in the country, a snack bar, and restaurants. Five, 7½-, and 10 ton packaged air conditioners are used.

Installation was made by the Edison Cooling Systems, Inc., of New York. ‡

ONE of the five rooms at the Yankee Stadium Club air conditioned before the World Series is the bar — one of the longest in the country

Consulting Engineers Issue New Conditions

. . . for specifications

SPECIFICATIONS "General Conditions for the Installation of the Mechanical and Electrical Work in Buildings" have been newly issued by the New York Association of Consulting Engineers, according to John K. M. Pryke, president.

The new conditions are supplementary to the General Conditions of the Contract for the Construction of Buildings, a standard form of the NYACE.

Copies may be obtained by writing to the New York Association of Consulting Engineers, 220 East 42nd St., New York 17, N. Y. ‡

Trend Is to Weld Small Pipe

. . . down to ½ in. size

THERE is now a pronounced trend toward welding small lines from ½ in. up, according to H. A. Sosnin, of Tube Turns.

He points out that: "Welded construction of small lines makes possible a variety of conditions." The following table shows the wall thicknesses for Schedules 40 and 80 pipe for several different pipe sizes:

Nominal Pipe Size, in.	Schedule 40 Welded	Schedule 80 Welded
2½	0.203	0.276
2	0.154	0.218
1½	0.145	0.200
1¼	0.140	0.191
1	0.133	0.179
¾	0.113	0.154
½	0.109	0.147

Mr. Sosnin also points out that flow conditions are improved when the smaller sizes are welded.

Another important consideration is the amount of time to weld various sizes of pipe. The following table, covering sizes from ½ in. through 2½ in., shows the time required to weld the various sizes of pipe in this range:

Nominal Pipe Size, in.	Weld, min.
2½	10
2	8
1½	7
1¼	6
1	5
¾	5
½	4

Mr. Sosnin, a practical welder, is the director of an educational campaign recently undertaken by Tube Turns. It is reaching thousands of apprentice pipe fitters in all areas. ‡

1956 Contract Awards 7 Percent Above 1955

. . . in first nine months

CONTRACT awards for future construction in September in the 37 eastern states amounted to $2,024,794,000, slightly below September 1955, according to the F. W. Dodge Corp.

Awards in the first nine months of 1956 totalled $19,411,066,000, 7 percent above the same 1955 period.

September awards showed gains or losses as follows: nonresidential at $775,369,000, 9 percent above September 1955; residential at $763,817,000, 4 percent above; and heavy engineering at $485,108,000, down 18 percent. ‡

Pipe Coal Slurry 110 Miles from Mines

. . . to steam power plant

"LIQUID" COAL will soon be flowing through the first commercial coal pipe line, a 110 mile, 12¾ in. line

from the strip mines in southeastern Ohio to Cleveland.

Work was completed by William Bros., pipe line contractors, at a rate of 2½ miles per day. The unique line extends from the Pittsburgh Consolidation Coal Co. mines near Cadiz to The Cleveland Electric Illuminating Co.'s giant Eastlake steam power plant, just east of Cleveland on the Lake Erie shore line.

Pittsburgh Consolidation and CEI embarked on the $12 million project after 6 years of research proved the feasibility and economy of the hydraulic transport of coal. The coal will be pulverized as it comes from the mine, mixed with water, and pumped through the line as "slurry" to its destination where it is dried and processed. The pipe line will supply over 1 million tons of coal a year — 3200 tons a day — to CEI's generating plant, representing approximately 30 percent of its total fuel requirements. ‡

1956 Room Unit Sales 15 Percent Above 1955

. . . inventory higher also

SALES of room air conditioners during the 1956 summer season exceeded the 1.5 million units forecast early in the year, according to Geo. S. Jones, Jr., managing director of the Air-Conditioning and Refrigeration Institute. Last year's sales amounted to about 1.3 million units.

The increase, representing a gain of more than 15 percent, probably would have been much greater but for the cool weather which prevailed throughout most of the country during July and August, Mr. Jones said.

As a result of the cool weather, inventories in the hands of manufacturers and distributors as of August 31 totaled 376,000 units, compared with 240,000 units on hand on the same date a year previously. The inventory gain amounts to 11 percent of total retail sales. ‡

Power Show To Be Held In New York This Year

. . . November 26 to 30

BACK to New York for 1956, the National Exposition of Power and Mechanical Engineering will be held in the Coliseum. Under the auspices of the American Society of Mechanical Engineers, this is the 22nd annual power show.

New and old friends of HPAC will be welcomed in Booth 570 by members of the staff. ‡

Engineer Shortage Called Critical

. . . by Industry leader

INDUSTRY'S spiralling need for engineers is a critical situation demanding increased consideration by industrial leaders and educators alike, according to D. C. Minard, president of The Trane Co.

Pointing out that one in every four of his company's office employees is an engineer, he said recently, "Since 1950, the number of our research and development personnel has increased by more than five times, and we see even greater need for qualified engineers to meet our projected planning for the years ahead."

He added, "Business and industry are becoming more complex each day, making it increasingly important that more engineers be available. The opportunities for engineers in both development and management are practically unlimited."

Mr. Minard said that The Trane Co. now gives yearly scholarship and fellowship grants to over a dozen top educational institutions. ‡

Tells Ways To Help Engineer Shortage

. . . aid students, teachers

THERE IS MUCH that can be done to solve the engineering manpower problem locally, according to Carlyle M. Ashley, national president of the American Society of Refrigerating Engineers and chief staff engineer for Carrier Corp. He suggests several practical steps to take.

For example, promising high school students should be advised to take the right courses so that they can be admitted to engineering schools. They must not neglect getting enough math or science.

Engineers and engineering societies should promote high school science clubs and plant tours, and should sponsor movies and talks on engineering. Too, they can offer achievement awards of various kinds to mathematics and science students.

Steps can be taken to encourage more teachers to enter the fields of mathematics and science, he believes. Engineers should invite teachers to attend meetings of technical societies, and to promote fellowships for science teachers.

Industry is learning to utilize available engineering personnel more efficiently, according to Mr. Ashley — although much remains to be done in this direction. For example, computers can free many engineers from routine calculations, technicians can do much of the work now performed by engineers, and technical clerks for such jobs as specification writing can make more of the time of trained engineers available for creative work.

By stressing the professional status of engineers as such, more trained engineers can be kept in engineering work, rather than switching to administrative and other non-engineering positions, he feels. ‡

"Quote"

"Air conditioning in five years will be as common as electric lighting."—*Samuel Littlejohn, commercial vice president representing General Electric Co. at the recent dedication of the complete factory air conditioning system of H. Daroff & Sons, Inc., Philadelphia men's clothing manufacturers.*

17 Prospects in One City Block

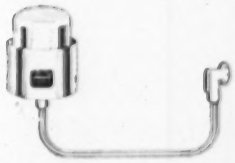
Prospects for the Webster Moderator System are everywhere. In one downtown block of a midwestern city, a recent survey showed 17 steam-heated buildings without central, automatic, continuous-flow control. The same situation is duplicated in major cities from coast to coast. All of these prospects — and many of them may be *your* prospects — can save money, simplify heating plant operation and gain new heating comfort with a Webster Moderator System.

Here is the weather-controlled continuous steam flow system that actually pays for itself in fuel savings. Introduced by Webster in 1927, the system has been constantly improved in details without altering the basic soundness of its original principle. And today's new electronic Webster Moderator System assures economical, winter-long comfort to match the summer-long luxury of modern Webster Air Conditioning.

For steam-heated buildings old or new, investigate the fuel-saving, comfort-producing advantages of the Electronic Webster Moderator System. See your Webster Representative, or write us.

Address Dept. HP-11

WARREN WEBSTER & COMPANY
Camden 5, New Jersey



Outdoor Thermostat varies heat delivery automatically in accordance with outdoor temperature changes.

Webster Variator provides convenient manual control when desired.

Main Steam Control Valve graduates or throttles amount of steam admitted to the system. Balancing of steam distribution is achieved by means of accurately sized metering orifices in radiator supply valves.

WEBSTER
MODERATOR
SYSTEM
OF STEAM HEATING

"Controlled by the weather"

LOCATED NEAR YOU — TO HELP YOU. Webster Representatives in these 65 U.S. Cities: Albany, Atlanta, Atlantic City, Baltimore, Bethlehem (Pa.), Birmingham, Boston, Buffalo, Butte, Chattanooga, Chicago, Cincinnati, Cleveland, Columbia, Columbus, Dallas, Davenport, Dayton, Denver, Des Moines, Detroit, Grand Rapids, Harrisburg, Houston, Indianapolis, Kansas City, Kingston (Pa.), La Porte (Ind.), Little Rock, Los Angeles, Louisville, Lubbock, Memphis, Milwaukee, Minneapolis, Nashville, Newark, New Haven, New Orleans, New York, Oklahoma City, Omaha, Orlando, Philadelphia, Pittsburgh, Portland, Raleigh, Richmond, Roanoke, Rochester, Saginaw, St. Louis, Salt Lake City, San Antonio, San Francisco, Seattle, Spokane, Springfield, Syracuse, Toledo, Trenton, Tulsa, Washington, Wichita, Wilmington.
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NESBITT SILL-LINE RADIATION

CONCEIVED WITH IMAGINATION
BUILT FOR A LIFETIME . . .

NESBITT SILL-LINE RADIATION is the fulfillment of an ideal.

For so it began—as a *concept* of protective comfort along
the cold front of a living or working enclosure—
fin-and-tube convector-radiators at the sill or wall perimeter—
encased to look more like fine furniture than heating equipment—
designed for low-cost installation in a high-wage era—
built to outperform and outlast conventional products—
and backed by an honored name in the realm of thermal comfort.
How well Nesbitt has succeeded in translating image to reality
is confirmed by architects' preference for Sill-line Radiation.

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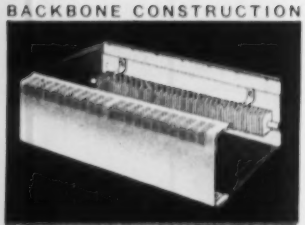
BACKBONE CONSTRUCTION



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"Open for Discussion"

• WE FOLLOW HERE each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to take part. Just address your comments to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

What's a Good Specification? Here's One Manufacturer's Idea

THE ARTICLE, *Do "Base Bid" Specifications Reduce Costs, Improve Quality of Heating, Piping, and Air-Conditioning Jobs?*, in the May HPAC, by Kenneth M. Wilson is an interesting viewpoint of a highly controversial subject. Now that the consulting engineer has expressed himself, what does the manufacturer think of it?

For the benefit of those who did not read the article or do not remember it exactly, Mr. Wilson outlines three types of specification:

1. An "open" specification. No names are used, only the performance, capacity, and construction are given for each piece of equipment.

2. A "bidders choice" specification. Here three or more brands of an item are mentioned, with the contractor selecting the brand but not being required to state in his bid what brand.

3. A "base bid" specification in which each item is specified by manufacturer's name and model number, with no alternates except those approved in advance of the bid opening and then with a separate price for each, or substitutions after award of contract with price information either plus or minus.

Mr. Wilson says he has developed the "base bid" specification (No. 3) to cure defects in the first two types outlined above. He says it pleases all concerned, simplifies work by the engineer and contractor, and results in substantially lower installation costs. Certainly such a specification would be a godsend to the industry. My only question is how well it would work out if generally used all over the country. I am somewhat afraid it might lead to difficulties and be abused, in spite of the fact that it seems to work out so well in Mr. Wilson's obviously capable hands. Perhaps I can suggest some modifications which would eliminate my anticipated troubles. For example, in describing his difficulties with an "open" specification, he says that in relation to items like heating coils full details of heat emission, heat exchange, heating surface, and entering and leaving air temperatures must be set down. Correct, but he has to establish those factors anyway, so why not put them down in the specifications? If he doesn't, let's see what happens.

Suppose it is a unit heater we are talking about. Suppose he has calculated that 100,000 Btu per hr output is actually required at a given steam pressure or hot water temperature and entering air at 60 F. He wants to specify a John Doe unit, and on looking at that maker's capacity tables he finds a unit at 90,000 Btu per hr and the next larger size at 112,000 Btu per hr. In order not to be 10 percent short, he probably selects the larger unit.

Now I have a unit with an output of 98,000 Btu per hr. Will the contractor try to submit my unit as an alternative for approval? No, he'll think that Mr. Wilson will say "No" because it's 12½ percent undersize, and he is probably right in not bothering with it. My next size is 120,000 Btu per hr, but I cannot offer it because my price is out of line. So I don't bid, yet my 98,000 Btu per hr unit is actually only 2 percent short, which is negligible; but no one knows it because apparently 112,000 Btu per hr are required. In fact, my smaller unit might easily be better for the job because it would operate more steadily and perhaps have a lower outlet temperature. It would probably cost a little less, too.

Mr. Wilson says that with an "open" specification he has to go into complete details of construction. Here, again, I would raise a question. Should he tell the manufacturers how to build their units? They may differ as to fin gage, spacing and size. They may use slightly different tube sizes and header construction, and so on. The John Doe unit mentioned above may have a ⅛ hp motor and mine a 1/10 hp motor just because my unit handles a little less air and has less friction due to fin spacing. Aren't these things for the manufacturer to determine? If Mr. Wilson has had some bad experience with a particular detail, for instance a flimsy cabinet, he can very easily specify the minimum gage for the sheet steel, etc.

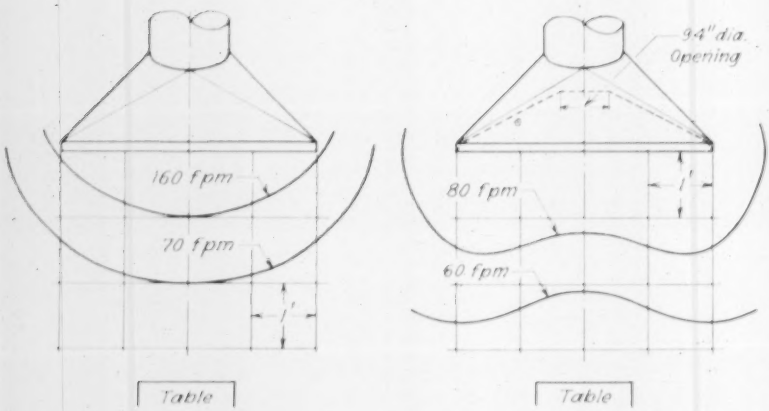
Then, too, how long is Mr. Wilson going to keep on specifying a John Doe unit? Other makers may bring out a better one, but the salesman offering that unit may have given up calling on Mr. Wilson because he feels it is a waste of time. The most important factor in the improvement of equipment is competition between manufacturers to dominate the market. Most manufacturers' sales engineers work on a commission, or at least some kind of a bonus, and naturally they tend to go along the line of least resistance and neglect the consulting engineer who has set his specifications in behalf of some other make.

Maybe Mr. Wilson takes care of this situation by in-

terviewing all salesmen and making up his mind on each job which manufacturer to name in his base bid, although that seems like a lot of work and is likely to lead to some kind of a rotation of specifications among the various manufacturers to give each a "break."

Actually, much of the equipment used in heating systems has become very well standardized, and this is rapidly becoming true of air conditioning equipment. Take radiator traps and valves, for example. They all have the same capacity and roughing in dimensions. All those on the market today are good, because poor traps died and went off the market years ago. The same is true of some types of convectors and finned pipe. The dimensions are not exactly alike down to the fraction of an inch but close enough for most jobs. The testing and rating is now being made uniform. One thing Mr. Wilson might worry about is the gage of the steel sheets used for enclosures, and here he can easily specify the minimum gage.

And so on down the line. In some cases, as with boilers, the type must, of course, be specified; and if space is at a premium, certain limitations of dimensions must be set. This might apply to condensate and vacuum pumps as to height of inlet or location.



5 VELOCITY CONTOURS for plain canopy and double canopy hoods are compared here. Note the higher rim velocity for the double canopy type for the same air flow rate

Double Canopy Hood Is Old Idea— Why Perform Exhaust Tests with It?

I HAVE BEEN considerably disturbed in reading the article, *Exhaust Hood Tests Provide Design Data*, by Professor A. B. Epple in the February HPAC. The double canopy hood is an old idea in industrial ventilation and has been shown time and again to be of no value. To be sure, the double canopy hood produces a high air velocity within about 2 in. of the rim. However, no one has ever shown that there is any advantage in producing a high velocity at this point.

The data showing velocity contours in Fig. 5 in the article — see above — makes it impossible to draw conclusions from these contours. In the first place, the volume of air flowing into the double canopy is larger than that in the single canopy, as pointed out by the author. Since for the same static pressure in the duct the volume of air flowing into the double canopy should be appreciably less than that flowing into the single canopy, this means that the static pressures for the two hoods shown in Fig. 5 are considerably different.

Also, one drawing shows contours for 70 and 160 fpm, while the other shows contours for 60 and 80 fpm. How is one supposed to make any meaningful comparison under these circumstances? Even if one interpolates to obtain comparable contours — a very risky business — there is still nothing to show any advantage for the double canopy hood. The author points out that the double canopy hood has very high entrance losses which should be enough to condemn it in the absence of any demonstrable advantages.

I was also puzzled by the studies on the distribution of air between the slot and the center hole. The author found that 60 percent went through the slot and the 40 percent through the orifice. Obviously, this distribution depends on the physical design of the inside canopy. However, he proceeds to use this as a method of designing a double canopy and designs it so that he will get this 40-60 distribution. I see no reason why this particular distribution has any advantage over a 50-50 or 20-80 or any other distribution ratio.

Again, in his design of the slot for the double canopy, he states, "An average velocity of about 2000 fpm has been found to be satisfactory for exhaust slots." The actual slot velocity which is desirable for a double canopy has never been studied to my knowledge. Slot velocities have been studied for horizontal

Mr. Wilson goes on to say that with his "base" specification he can make complete detailed drawings, and the contractor can make more accurate bids when the exact equipment to be used is known in advance. Now maybe he does make such accurate and detailed drawings — I have never seen his drawings — but all the drawings I have ever seen are what might be called "flow diagrams" showing the locations and sizes of pipes and ducts and other equipment, with here and there a detail of some hook up. But it is generally considered that the contractor must in any event make up his shop drawings regardless of what is shown on the engineer's plans. This is especially true of boiler room piping. There are too many changes made in the building construction or layout between the time the engineer completes his plans and the award of contract and actual installation which mess up the plans. Then finally Mr. Wilson permits alternates if approved six days before the bid opening, and this alternate equipment may not have the same roughing in dimensions as the equipment already on the plans.

Mr. Wilson says that his specifications are "welcomed

continued on next page

slots used for ventilating open surface tanks. Here, too, such velocities vary, depending on the actual conditions of operation. An arbitrary figure of 2000 fpm seems to have no particular advantage for design purposes.

The second part of the article dealing with push-pull systems is interesting, but adds nothing to our knowledge in this field, which has been covered so well by the work of Ege and Silverman. No reference is given for Equation 3, which is used for calculating the blow volume, and it is difficult to see the justification for it.

$$Q_1 = [1/(L \times E)]\, Q_2 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots [3]$$

where Q_1 = the blow volume, cfm; Q_2 = the suction volume, cfm; L = length of table; and E = entrainment factor of 2 for a 7 ft table.

Ordinarily, in a push-pull system the blow volume is calculated first, and the exhaust volume is that required to remove the blow volume plus entrained air.

I am sorry to see this old concept of the double canopy hood given an unjustified boost, as this article seems to do, without data to support this boost.

H. F. Schulte
Group Leader
Industrial Hygiene Group
Los Alamos Scientific Laboratory
University of California
Los Alamos, N.M.

The author replies —

The comments offered by Mr. Schulte on my article, *Exhaust Hood Tests Provide Design Data*, were very interesting. I appreciate his desire for all of the details on this subject. I omitted some of this information in my effort to make the article more readable.

I will first discuss the comments on double canopy hood. I have read several statements that they were not good, but these were never backed up with tests. I got my early training from men who had good success with this type hood. Their design procedures included some judgment factors that I wanted to eliminate by tests, and that was my objective in doing this work.

Because the division of flow between the rim and center slot was an important factor, tests with different size, center, and slot openings were conducted until good control of the released smoke was attained. This size was then used for the volume tests given in the article. That is how the 60 percent through slot, 40 percent through orifice was determined.

The velocity into the slot should be high enough to give a concentration of flow, but not so high that excessive static suction is required. I have found that 2000 fpm is a good compromise for slot exhaust of vapors from tanks, and the manual "Industrial Ventilating," by American Conference of Governmental Industrial Hygienists suggests the same value. For these reasons, I used this value on the double canopy.

The contours shown in Fig. 5 for the two types of hoods were from separate tests, and unfortunately the same velocities were not plotted. However, the velocity is 80 fpm, 1.5 ft down from the rim of the double canopy and only 70 fpm at a point 1.3 ft down from the single canopy. This was the comparison I was thinking of when writing the article.

I should not have mentioned the difference in volumes flowing into the single and double hoods as it was only 220 cfm or 5.8 percent, but to be a truthful reporter, I put it in. It would make a very slight difference.

The static suction on the double canopy must be a little higher than the plain, but the difference is not enough to make it a serious factor.

Equation 3 for the determination of the flow volume was taken from the Industrial Ventilation Manual mentioned above. I am aware that Silverman has done some excellent work, but this manual is used as a text here, and the study was based on the method of calculation given in it.

I hope this answers Mr. Schulte's questions, and I again want to express my thanks to him for his thorough study of the article.

A. B. Epple
Associate Professor
of Mechanical Engineering
University of Michigan
Ann Arbor, Mich.

by all suppliers, whether their products are named in the specification or not, and the competition between suppliers is keen." If by "suppliers" he means jobbing houses competing with each other to sell the specified make, I can see where competition between them might be "keen." If he is referring to the manufacturers who may sell either through jobbers or direct to the contractor, then where is the competition when one make is specified "flat"? I use the word "flat" instead of "base" because, as I shall try to show presently, his "base" specification really turns out to be exclusive to one manufacturer regardless of the provision for alternates and substitutions. The sales engineer whose equipment is named thinks it's just fine, but what do the others think?

Mr. Wilson thinks he has taken care of this by his clause, "Materials of approved equal." The trouble here is that, with hundreds of items to consider, it is unlikely that a contractor will care to take the trouble to submit a list of alternates before he makes up his bid. There usually isn't time for that anyway, and if he can't make any money out of these alternates, why bother?

Finally, we come to the clause, "Substitutions (after execution of contract) of equipment." Here again if the contractor can't make any money, he isn't interested. On the other hand, there is opportunity for collusion between him and the manufacturer's agent. There are times, however, when a contractor sincerely wants to make a substitution because he thinks he'll have less trouble or better service from a manufacturer other than the one specified.

When it comes to "systems," then the consulting engineer does well to decide exactly what system is best for the particular job and specify it without permitting either alternates before bidding or substitutions after award. I refer particularly to temperature control and some air conditioning systems. These differ quite widely in performance and suitability. Some are proprietary. Some require that the system manufacturer supply many components of his own manufacture which would otherwise be supplied by different manufacturers. Here the consulting engineer is well justified in settling on one type and specifying it by name as well as operating characteristics and then sticking to it. As a minimum, the type of system should be specified, and if there is more than one manufacturer, several names should be used. All this means a properly installed and serviced job. The sales engineer should be permitted to make enough money on the sale to render adequate service for the first year.

Mr. Wilson claims that after he began using his "base" specification on some school jobs, the final cost of these jobs went down 20 percent and more. Certainly, equipment costs are not going to go down, so this huge saving must be elsewhere. Personally, I cannot see how any saving in the cost of executing the contract would equal 20 percent of the total cost. Meantime, I wonder if Mr. Wilson hasn't at the same time made savings in other ways to account for this reduction.

I have no doubt that contractors like a tight specification, one which tells them just what will be permitted, one which keeps some dark horse from horning in with a low bid on cheap substitutes. I know also that they don't like to be deprived of their purchasing power after award of contract. In this regard, it is quite true that with an "open" or "bidder's choice" specification, competition between suppliers or manufacturers is apt to get out of control, and no one makes the money he thinks he is entitled to except perhaps the contractor. It is also true that when the equipment men don't make any money, they also don't like to go out and render service. Fortunately, there is usually enough business to go around and satisfy nearly everyone, although at times it does seem as if there were too many manufacturers of certain items.

What, then, is a manufacturer's idea of a good specification? It is hard for one man to make a general statement, and probably what I say now will be challenged by other sales engineers. But for what it's worth, here goes.

1) For equipment which is fairly well standardized as to capacity and/or dimensions, a general description for the job is usually enough. The engineer has ample opportunity in this general description to incorporate essential features of design and construction and to include improvements brought out by the various manufacturers. Some details need to be defined, such as sheet metal gages, horsepower and speed limits, maximum overall dimensions, etc. To this might be added a list of approved manufacturers. The preparation of such a list may seem like quite a job and it is, but it can be done piecemeal, and once set up it can be used continuously with little effort other than to keep it up to date. It's then up to the salesman to get on this list and see to it that his name isn't removed due to some trouble with his product.

2) For nonstandardized equipment, such as temperature control or air conditioning systems, a performance specification with a list of approved manufacturers or, in the case of proprietary systems, one manufacturer's name and model or type number should be given.

3) For special equipment, which may have to be designed to fit in a given space and to accomplish a special result, a "flat" specification with no alternates and no substitutions should be used.

4) Where appearance is an important factor, as for example baseboard covers, select the model desired and specify it "flat."

In the case of "large power and industrial process projects" referred to in the comments by Lee P. Hynes, whose comments were published with the article, I agree that there is substantial justification for a strong "base" specification, even stronger than the one suggested by Mr. Wilson, because most of the equipment will be special, falling into Item 3 outlined above.

The writer of these comments is a sales engineer with a manufacturer. His name is withheld by request.

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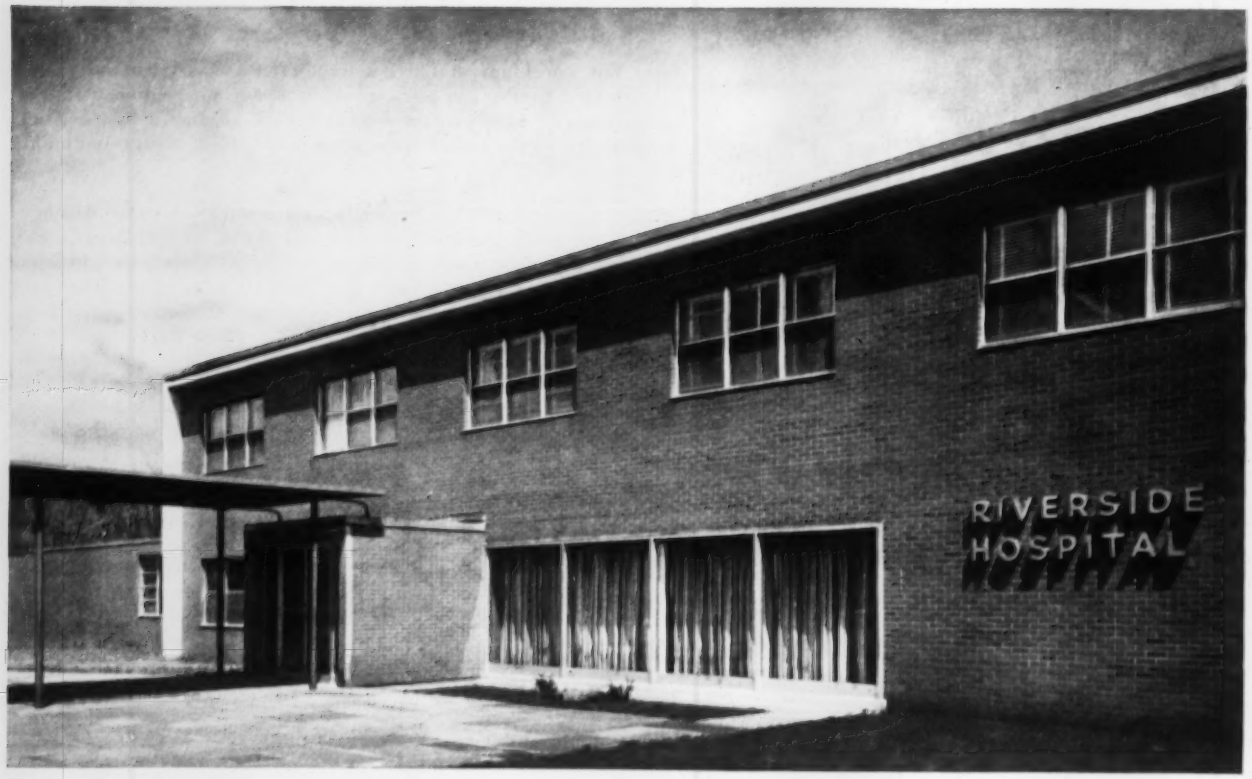

Low-cost New Jersey hospital shows how

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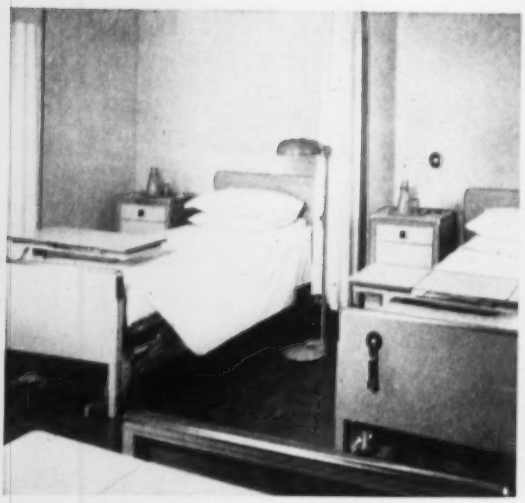
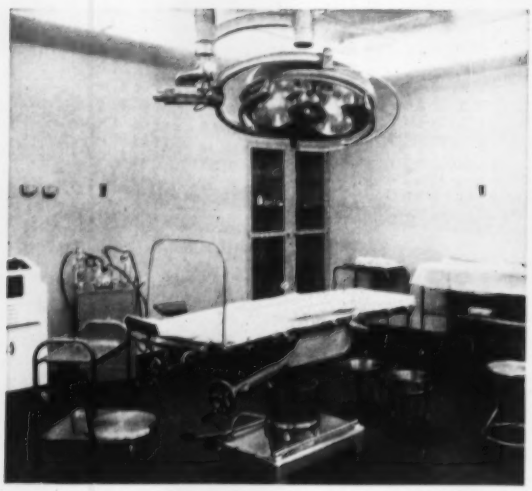


Thermostat on the wall gives occupants of Riverside Hospital bedside temperature control. Patients have only to dial the temperature that suits them best. The Honeywell thermostat then maintains it accurately and dependably, regardless of the room's exposure or changes in the weather outdoors. Every patient bedroom is thermostat-equipped.



Use factor helps determine building's control needs. In the operating rooms, for example, temperature requirements are not the same as in patient bedrooms. Number of people present in some areas varies, creating still another type of control problem. In all cases, Honeywell thermostats precisely control heating, cooling and ventilating as needed.

Floor plan showing thermostat placement, Riverside Hospital, Boonton, N. J. Architect: Lance B. Bell & Associates. Hospital consultant: Otis Auer, Consulting engineer: Sloan & Fuller. Mechanical contractor: Max Roth, Inc. General contractor: Frank Brescia Company, Inc. Hospital administrator: Herbert N. Morford.

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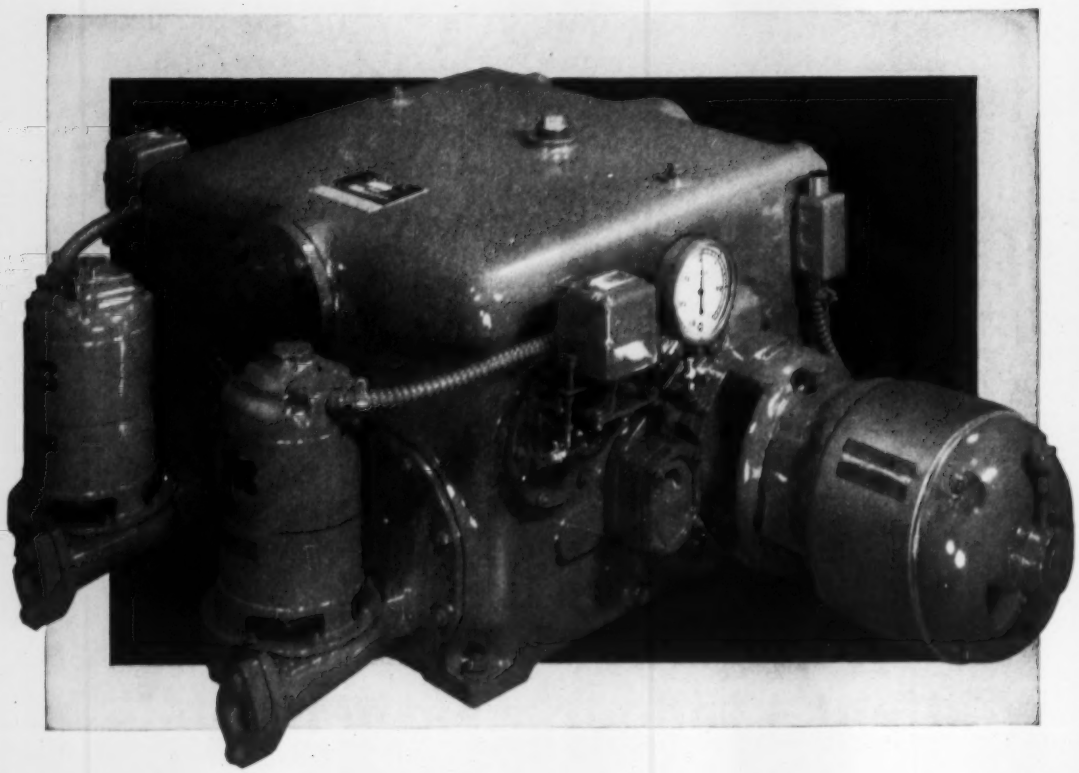

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These pumps possess many other features which permit a more efficient utilization of fuel and minimum use of electric power. Low, low, returns reduce installation costs and usually eliminate putting the pump in a pit. Simplicity and efficient operation reduce supervision and maintenance costs. Information regarding this new heating pump development is available immediately upon request.

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- Separate air and water pumps individually selected to meet actual job requirements.
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Careful attention to several key factors will materially reduce the cost of piping maintenance. These factors are: costs of labor and material; proper engineering of the piping installation; proper selection of piping materials; relative cost of welded vs threaded joints; installation for ease of maintenance and ease of operation; annual upkeep required; adequate records for control of maintenance.

In a survey of 117 plants, the author discovered an inexplicable complacency about maintenance economy. A step in the right direction, he says, is improving records for controlling this important item of expense.

How to Cut Maintenance Costs Of Industrial Piping Systems

BY ROBERT J. PINSKE

THE TREND to more complicated piping systems is readily understood when the complex demands of modern industry are considered. Several developments have aided this trend for air, steam, oil, water, chemical, and other services.

Instrumentation, providing automatically controlled sequences of opening, throttling, or closing of the proper valves, not only has resulted in a great saving of labor, but has achieved greater uniformity and a better product in many cases than with hand control. Improved piping materials, equipment, and installation techniques have been, and are being, developed to withstand new and more severe operating conditions. And more economical fabrication of the piping system is now available with unit fabrication.

Yet not all of these advances have added to the cost of a piping system. Some have reduced expenses considerably. The ultimate cost of a system depends upon several key factors. These include:

1. The costs of labor and material.

2. Proper engineering of the piping installation.

3. The proper selection of piping materials.

4. The relative cost of welded vs threaded joints.

5. Installation for ease of maintenance.

6. Installation for ease of operation.

7. Annual upkeep of the piping system.

8. Adequate records for control of piping maintenance.

Mr. Pinske is sales manager, heating and industrial division, Warren Bare Supply Co. Previously he was a power plant engineer with Crane Co.

1. Costs of Labor and Material Rising

Productivity and the wage price ratio have a strong inherent tendency to move together. This relationship existed long before the rise of labor unions to their present strength. The tendency is irrespective of the form of industrial organization that may exist at any particular time.

Increasing cost of labor and material has led to a very rapid decrease in the purchasing power of the manufacturers' dollar. The trend indicates a slight continuing rise in the amount of raw materials that can be purchased by the manufacturers' dollar and a steady decline in the amount of labor that can be purchased by the same dollar.

This steady decrease in the manufacturers' purchasing power of labor can be attributed to the fact that the majority of managements strenuously resist demands for increases in wages but tolerate a 50 percent inefficiency in the worker. This is particularly true in the field of maintenance workers employed by industrial plants.

Over a recent 12 year period, the increase in the cost of valves and fittings was 109 percent, while that for pipe was 97 percent. For the same period, the cost of labor of pipe fitters employed by industrial plants increased 113 percent, and of pipe fitters employed by outside contractors, 76.5 percent.

A survey of industrial plants showed that plants which contract piping work to an outside contractor find it is from 20 to 40 percent more economical. The reasons that it is often more economical are obvious if the training of the two types of pipe fitters is compared. Outside contractors require their apprentice pipe fitters to serve a five year apprenticeship before becoming journeymen pipe fitters. During this period the apprentice must attend a trade school for pipe fitters one day each week for the full five years and must then pass a comprehensive examination. The piping contractor pays for this training.

The pipe fitters employed by the industrial plants, in most cases, receive little formal training, the survey showed. The training they do receive is usually obtained by learning the trade from fellow workers, who in some cases received the wrong training themselves. The seniority clause in most industrial plant contracts permits any individual to bid on a pipe fitter's job, regardless of background or ability. But he must prove his ability to learn and acquire the necessary skill in 30 days. This, as the author has observed in various plants is quite easy to do. After 30 days on the job, it is automatically his. The industrial plant must absorb this cost, which obviously is added to the cost of piping maintenance.

The present trend of the industrial plant unions, where it will affect piping maintenance expenditures, is as follows: reduction of all requirements of ability and skill in promotions, lay offs, and transfers from other departments, the prohibiting of contracting piping work to outside contractors, a guaranteed annual wage, and the reduction of all incentive plans.

Management must consider these factors when deciding to perform the work with their own pipe fitters or contract the work to an outside piping contractor. The size of the piping job must be one of the determining factors in contracting the work out. In many cases, too small a job would not be economically feasible.

2. Properly Engineer Piping Installation

One of the most positive and profitable approaches to preventive piping maintenance is through proper design of the piping system. Operation of a plant piping system burdened with poor design characteristics will always require an ever increasing amount of maintenance. Unless that design is adaptable to change or correction, maximum efficiency is adaptable to change or correction, maximum efficiency is only a mirage, and repairs must be constantly made.

High steam pressures and other advances have given industrial and utility plants increased performance figures. But these developments were acquired at the sacrifice of simplicity. They have brought increased maintenance of practically every piece of piping equipment. An example is the boiler feedwater system through the steam generator and the entire steam distribution system up to the various points of use.

The use of compressed air, water, oil, and chemicals in various manufacturing processes has also increased in complexity because of the requirements of continuous and automatic operation of production equipment. These increased sources of piping maintenance argue the desirability of simplicity in design as an initial and effective attack on piping maintenance problems.

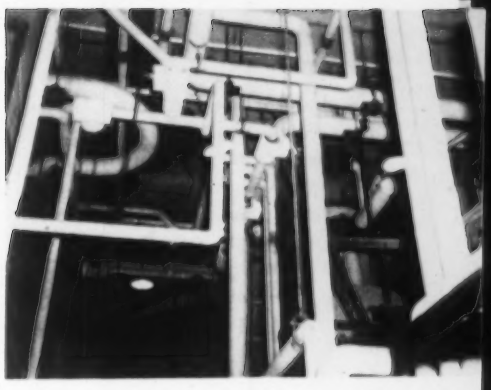
• The pipe sizes chosen must be neither too small nor too large. Undersized pipe in steam lines will result in excessive pressure drop, excessive velocities, and failure to deliver the required quantities of steam of the required pressure at such points of the system where they are demanded. Oversized pipe entails unnecessary expenditures not only for the more costly pipe, valves, and fittings, but for greater quantities of insulation and hanger materials also. A rough approximation of line sizes may be made if the quantity and pressure of steam are known by assuming a reasonable velocity of flow. Several authorities recommend velocities of 1000 to 1200 fpm per in. of pipe diameter.

The success or failure of a carefully designed steam system often depends on the correct sizing of the supply and condensate return piping. That this seemingly minor factor is often under-estimated was apparent when the steam heating systems in a number of industrial plants were inspected. A number of the systems

were noisy, developing air binding and water hammer, and were not operating properly. The same principle of proper sizing applies to a hot water system, plus the added requirement of maintaining adequate differential pressure between the supply and return lines.

• Thermal deflection of piping in high pressure, high temperature applications necessitates flexible support. To install the improper type of piping supports is to assure excessive and unnecessary piping expenditures in future maintenance. Where reactive forces at terminal points in a piping system must be kept within specified limits, constant support type hangers are recommended. They are designed to provide substantially uniform supporting force equal to the pipe load throughout the travel range and should be used at superheater outlets, turbine connections, and also on high temperature and other critical lines. When pipe lines are subject to vertical movement and restrictive conditions do not require the use of a constant support type variable spring hangers are recommended. They should be designed to support not less than 85 percent or more than 120 percent of the load. When necessary to prevent abnormal movement or vibration in pipe lines, controls or sway braces of the energy absorbing or instant acting counter force type are recommended.

• The failure to provide adequate drips and drains will inevitably exact its toll in added costs. In the design and installation of power and process piping, the drips and drains too frequently are treated as an afterthought, receive casual attention, or are relegated to a very minor position in planning. Consequently, they are often inadequate, makeshift, or at best are only partially effective. The American Standard Code for Pressure Piping requires that "suitable drains or drips shall be provided wherever necessary to drain the condensate from all sections of the piping and equipment where it may collect. Suitable drains shall also be provided for emptying water lines, water storage tanks, equipment containing water, etc., at times when such piping and equipment may be out of service. At least one valve shall be placed in each drip or drain line."



Thermal deflection of piping in high pressure, high temperature applications necessitates flexible support

Drips and drains, though relatively small in pipe sizes and relatively minor in total tonnage compared with the major piping, should be regarded as an important and integral part of the piping system.

• The most important factor in the design and installation for rapid and efficient piping maintenance is the bypass valve. Installing a bypass valve and line around all meters, controls, pressure reducing regulators, and traps is exceedingly important if piping maintenance expenditures are to be kept to a minimum. Globe valves should always be used in these installations because of their ability to be hand throttled without excessive wear of the seats and discs. The failure to provide bypass connections will in all cases cause unnecessary expenditures for overtime work and the possibility of shutting down a vital part of the plant production.

• The remedies for low air pressure are just as definite as the causes and effects. Faulty air power conditions are usually due to poor planning or to increased air uses without corresponding system expansion. Plant wide analysis will determine the full extent of low air pressure and the present air flow requirements. Future plant expansion must also be considered. Where possible, a loop system should be used around the plant and within each shop and building. This allows a two way distribution system, it must be remembered that oversize piping costs little more than smaller sized piping because over two thirds of the initial expense is for labor.

The carrying capacity of compressed air pipe lines is often reduced by water, oil, and dirt which may accumulate and cause trouble, as well as constituting a safety hazard. Accumulated moisture in a compressed air line may result in water hammer or may freeze in cold weather. Water vapor precipitates in the air system when the air cools. In long transmission lines the water will settle out of the air and flow along the bottom of the pipe. To prevent this condensate from being carried along to the equipment where the air is required, the low points of the line as well as directly before each takeoff connection should be trapped as a steam line is trapped. The main supply line is usually pitched in the direction of flow and a trap is at the end of the run.

It is important to protect each piece of air consuming equipment with a strainer or separator. The practice of blowing air lines to free them of water or condensate should be avoided because it results in an appreciable loss of air. Instead, lines in which moisture is known to collect should be provided with separators. These need not be elaborate; a piece of pipe, say 4 in. in diameter and 2 ft long, at the end of a feed line may suffice. The inlet should extend through and about 6 in. from the top of the separator and the outlet to the hose manifold should be at its highest point.

The trap must be drained from the bottom as often as it is found necessary. The frequency with which this is done will depend to some extent on the weather. If separators

and drains are conveniently located they will be operated because no workman wants water in the air to slow up his work. The air losses discussed are common ones and can be easily remedied.

The causes of low air pressure are: insufficient compressor capacity, inadequate piping, and leakage. A measure of the adequacy of piping is the pressure loss between the air receiver, where the compressor endeavors to maintain a constant pressure, and the point of use. This should not exceed 10 percent in a well designed system. If the pressure drop is greater than an average of 10 percent throughout the entire distribution system, including all hoses in use, then attention should be given to correcting this fault before considering increased compressor capacity.

• Steam traps are required to function without causing a drop in line pressure. They should be located at the end of each pipe run and before a branch connection to a piece of equipment. If a slug of water is allowed to remain in a steam line, severe shock — "water hammer" — may result, with possible damage to equipment. The heating up time required for a jacketed vessel or heat exchanger is considerably lengthened if the jacket is not freed from the condensate which collects during the unheated portion of a cycle.

Traps must be sized correctly if equipment and supply lines are to function efficiently. The practice of selecting the traps of a size equal to the drain connection from the heater or piece of equipment is often wasteful. For each installation, four factors enter the calculations: maximum pressure, working pressure differential, anticipated condensate load, and a safety factor.

• Pressure reducing valves or regulators are installed to maintain a constant steam pressure lower than that available from the boiler or other source of supply. There are several types of design available but their operating principle is that of controlling the opening and closing of a valve by means of the reduced pressure acting upon the underside of the diaphragm through a port within the body, or by means of a control line connected to the pipe line on the downstream side, or to a pressure controller.

A strainer is normally installed directly preceding a pressure reducing valve and it is also good practice to install a trap at the takeoff point. A bypass should be provided around a reducing valve, so that hand throttling may be used if the reducing valve is removed from the line for repairs. A pressure gage must be installed on the downstream side. Also, a relief valve is required by the Code for Pressure Piping in every installation where a dangerous condition would exist if full line pressure were to build up on the low pressure side due to a failure of the reducing valve to function properly. An exception is made for steam plants where trained personnel are in attendance at all times. Where the pressure on the low pressure side is such that a lower rating of valves and fittings than that required on the high pressure side may be used, the higher rating must be continued up to the last shutoff valve preceding the relief valve of the system.

• The loss of heat from an uninsulated line will increase the cost of production considerably and at the same time may constitute a definite safety hazard to the operating personnel. Cold lines even of moderate temperature will cause an appreciable amount of condensate to form on the exterior of the pipe with consequent dripping and damage to equipment.

The type and thickness of insulation is usually a function of the temperature at which operation takes place. It may be just as poor economy to over insulate a pipe line, as to under insulate, or neglect to insulate it at all. The cost of insulating must be carefully balanced against the value of heat which would be thereby conserved. There are several kinds of insulation on the market, the choice of which depends on the insulating effect required, as well as on initial price, ease of application, and on its re-use possibility. #

Additional articles by the author on this subject will be published in forthcoming issues of HPAC.

Power Roof Ventilator Shipments Up 25 Percent

. . . over 1955 totals

THERE'S a definite trend to the use of power type roof ventilators for big buildings — industrial plants, commercial and school buildings, and multiple unit housing structures — according to the Air Moving and Conditioning Association.

According to Robert W. Nelson, president of the association, "From practically nothing in 1946, the value of shipments of power roof ventilators is expected to reach $15 million this year, an increase of 25 percent over 1955 totals. And the potential market is only scratched.

"The development is so new that the U. S. Dept. of Commerce, for instance, only this year has begun to compile census figures in this product classification. Ten years ago the concept of the package unit had not yet been adopted by many of our manufacturers. Generally, the separate components of power roof ventilators — the impeller, driving motor, shroud, etc., — had to be assembled by the contractors for installation. Today, the picture is entirely different. With the trend toward powered units, manufacturers now provide package units of varying capacities sufficient to handle most applications. All components are factory pre-assembled and tested. Thus, installation no longer requires field assembly."

Mr. Nelson also stated that power roof ventilators provide about the lowest cost means of expelling overheated air, fumes, and odors from a building. "Also, since most manufacturing plants — particularly in the metal working field — have heat producing activities, provision must be made for air changeover to avoid adverse working conditions." #

Question of the Month

Filter or Condense Salt Out of Air?

THE QUESTION, *Should I Filter or Condense Salt Out of Air?*, was published in the August HPAC and is repeated here along with an answer that has been received from a reader. Other answers for publication will also be welcome.

"We are interested in obtaining information as to how to filter salt air in an institution near the seashore. The salty atmosphere has a marked corrosive effect on all of the equipment with which it comes in contact, as we all know, and I would like to know how to handle this problem.

"I have considered the use of air filters, and I have considered the possibility of condensing the salty moisture out of the air as it passes through air conditioning apparatus. In each case, I have met doubt as to the soundness of the method.

"Any help or experiences that others may be able to cite will be greatly appreciated."—R. L. Z.

Use Filters or Dehumidification, Depending on Air Flow Rate

AIR TEMPERATURE, pressure, and flow rate have a decided influence upon equipment performance. Since this data has not been submitted by R.L.Z., the following comments may need to be modified to satisfy the prevailing conditions.

When air flow rates are not too high, filters may be employed for removing the salt. For this application, the filter mesh needs to be very small, which offers a high resistance to air flow. This type of installation may require fans or blowers capable of developing pressures in excess of the capability of those presently installed. If new units are to be purchased, the required high pressure will impose additional power requirements, involving greater operating cost. This is of particular concern when large air volumes are being handled. Use of filters requires one or more space units to allow nearly continuous salt removal while a filter is being regenerated or replaced. If the air flow process cannot be interrupted, it is necessary to install a bypass having filters to permit steady flow while the change is being made.

If large air flow rates are involved, cooling the air to remove salt laden moisture—dehumidification—is recommended. This method does not have the limited capacity attendant with filters. The cooling capability may be varied through a comparatively wide range, without requiring additional facilities or making extensive adjustments of installed equipment. Since air conditioning and associated refrigeration facilities are presently installed, R.L.Z. may be able to obtain the desired results by modifying the present installation at minimum cost.

Usually, dehumidification offers greatest flexibility for conditioning air.

H. B. WAYNE
Consulting Engineer
Woodhaven, N. Y.

Install Water Spray Scrubber In Air Intake Duct

I BELIEVE the most economical and practical method of removing salt from air is to install a water spray scrubber in the intake duct of the air conditioning system. The proper size and type of such a device would obviously be best determined by consultation with the manufacturers.

W. D. RODRICK
Plant Engineer
Raytheon Manufacturing Co.
Newton, Mass.

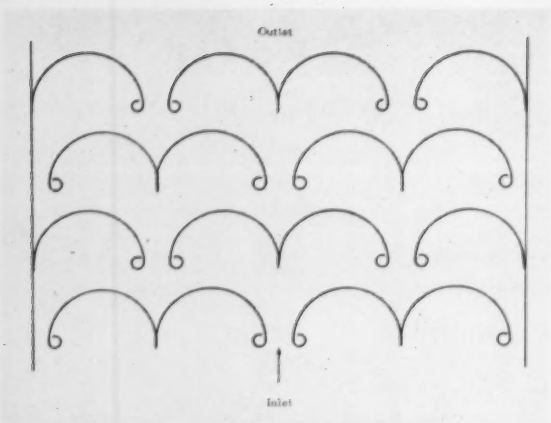
Solution Is Twofold; Filter Out Salt Particulates; Control Relative Humidity

IN COASTAL AREAS, particularly where the surf breaks on rock bound shores, the air is not only of high relative humidity, but is laden with fine spray particles, or mists, of water soluble salts. At many islands high winds—at times reaching hurricane force—as well as breaking surf contribute to high humidity and entrained moisture and salts from the sea.

In both cases, interiors of buildings along the shore are subject to considerable infiltration of liquid particulates and high humidities. If the structure is used to house delicate laboratory equipment and instruments, or fine precision machine work, or only for the storage of materials and supplies, considerable destruction can be caused by corrosion due to salt water and high humidity. Materials such as leather and fabrics are also subject to fungus decay and rot.

The problem is twofold: (1) removing the salt water mists or liquid particulates; (2) decreasing the humidity to a point where corrosion and decay will not occur.

Salt water mists can be removed by almost any means that might be used for the removal of solid particulates. However, the problem has its difficulties and economic



MIST EXTRACTOR, with semicircular baffles, is one means of eliminating salt water mists. Baffles impinge particulates; and centrifugal force sweeps them into small open vertical drain tubes. Ineffective at low velocities, equipment requires high velocity air flow for greater resistance, hence restricting power

considerations. These will depend on the removal and disposal of the salt water, the corrosion resistance, cleaning difficulties, and life of the equipment. Economic considerations will also be involved in the cost of the type of installation selected, and the efficiency of particulate removal and relative humidity desired.

If the installation is such that natural ventilation at relatively high velocities exists — for example, prevailing trade winds entering through a louver or open window — an extractor made of semicircular baffles and employing centrifugal action could be used. See Fig. [Use of such baffles to collect oil mist is described by the writer in the March HPAC, p. 141. — Ed.]

The number of baffle rows or vanes, four to nine, depends on the extent of elimination desired. Nine rows of baffles will produce close to 100 percent elimination, depending on velocity and design details. Four to six rows would meet the practical needs of most applications for the problem under consideration. This kind of eliminator or filter, impinges the particulates on the baffles, where they are swept by centrifugal force into the protected area of the small open tube, out of the air stream. The liquid particulates drain down the tube to a trap and then to a sump or means of disposal. This type of equipment has little or no effectiveness or resistance to air flow at low velocities or gentle breezes. Resistance increases rapidly at high velocities, acting as a restricting agent to limit the air flow under high velocities or hurricane conditions.

This extractor can also be effectively used with forced ventilation systems.

In section, the baffles are semicircular, like drainage gutters, but with the rolled lip turned in. This rolled lip, or tube portion, is open sufficiently on the side to admit the water. Two baffles are welded together at the unrolled edge to form a pair. Rows are arranged in a staggered pattern to permit air flow, each row extracting an increment of water.

Since this type of filter is not a standard catalog item and must be made for the application, there is freedom in the selection of the materials. Thus, any one of several corrosion resisting materials — copper, bronze, stainless steel, etc. — may be chosen.

In an installation where mechanical ventilation is employed, or where the restricting inlet action accompanying high winds is not a requirement, the liquid particulate matter may be effectively removed with the minimum of maintenance by an electronic precipitator assembly. This assembly should include a prefilter, an electronic precipitator, and an after filter. The prefilter can be of the permanent washable impingement type, constructed of crimped corrosion resistant metallic mesh, or can be of glass fiber. This prefilter would remove the larger particulate matter. It should be provided with drainage.

The fine mists that pass through the prefilter are then removed and collected by a specially constructed electronic precipitator. This precipitator would be of a standard commercial type, as constructed for oil mist removal applications. It would have approximately a 12,000 volt d-c power pack for ionization of the particles, and 6000 volts d-c for the plates of the collecting cell. It should be corrosion resistant. The standard aluminum construction would be satisfactory for most applications. The main difference in this precipitator as compared with those usually employed for air conditioning is that the insulators are out of the air stream. This is important when handling salt water particulates, as the mists might otherwise cause insulator flashover. Such a precipitator would be about 90 percent efficient at 400 fpm velocity. Higher or lower efficiencies are obtained inversely to the velocity employed.

An after filter should be employed to act as an air distributor or diffuser, assuring an even distribution over the face of the precipitator, and also affording a means of knocking down from the clean air stream any encrustations or deposits that might break loose from the plates of the precipitator.

The water in the air that is represented by the humidity is in the form of superheated steam and behaves as a gas or vapor. It is not removed by filters, as is the case with particulates or mists.

After the salt water particulates are removed, it will usually be necessary to remove some of this vaporized water and lower the humidity if corrosion is to be reduced to a negligible quantity. A relative humidity of 40 percent has been found to provide an atmosphere conducive to the preservation of finished and polished metal parts, fabrics, leather, etc. in one of several ways:

1) Dehumidification by refrigeration, direct expansion, spray coils, or washers.

2) Dehumidification by heating and ventilating.

3) Dehumidification by liquid absorbents.

4) Dehumidification by solid adsorbents.

If temperature control is not a factor, and it is desired to maintain 40 percent relative humidity, method No. 4 will probably afford the best solution.

The solid sorbents in common use are activated alu-

mina and silica gel. These materials have the ability to remove water vapor from air. The process is primarily one of condensation. Heat equivalent to the latent heat of evaporation of the vapor, plus the heat of wetting, is liberated. In practice, this causes a temperature rise of the dehumidified air of about 10 F per grain of moisture removed per cu ft of air. In most cases, the temperature rise is not sufficient to be an objectionable feature but can readily be removed by passing the air over water cooling coils or direct expansion refrigerant coils.

Usually two beds of dessicant are provided in one machine. A fan recirculates the room air over one bed, while the other is being reactivated and the moisture removed to the outside by a second fan and ductwork. The moisture is driven off by heating the bed with steam, gas, or electricity, to a temperature of about 300 F. A timed valve arrangement is employed to switch beds in the two circuits.

Actual conditions encountered, such as wind velocities, spray or liquid particle concentration, humidity of the entering air, and humidity and temperature desired within the conditioned area will be controlling factors in the selection of the filtering, extraction, and dehumidification equipment for the application. Standard air conditioning practices and calculations should be followed in the design, with due consideration to corrosion, drainage, and insulation within the equipment itself.

WARREN VIESSMAN
Engineering Consultant
Baltimore, Md.

READER ASKS—

Consulting Engineer Asks Help On a Tough Sales Problem

"Have Other Consultants or Contractors Run Into Anything Like This?" He Wonders

CONSULTING engineers and mechanical (heating, piping, and air conditioning) contractors have sales problems, too. Sometimes they're tougher ones than those facing equipment suppliers.

Here's one that's puzzling a consulting engineer reader of HPAC right now. He'd like any help or suggestions for solving it that other readers may be able to give him. Let's have him put it in his own words:

"Our office designed a very fine air conditioning system that went into operation last summer. It serves a comparatively small office building occupied entirely by one tenant. The top executive of the owner is holding back final payment because he maintains the system isn't performing as it should.

"That's where the 'puzzlement' comes, and here's why. The job was designed to hold 78 F dry bulb and 45 percent relative humidity at the outside design conditions of 95 F dry bulb and 75 F wet bulb. We checked the job carefully on a day carrying 74 F dry bulb and 50 percent relative humidity inside — well below what the system was designed to do and which the owner understood he would get when the contract was signed.

"Here's the tough part, as far as I am concerned, and I don't know just what to do about it. When I talked with the executive who is holding up payment, he admitted that none of his people had made any complaints about being uncomfortable. However, he said he didn't think the job was working right — and here's why!

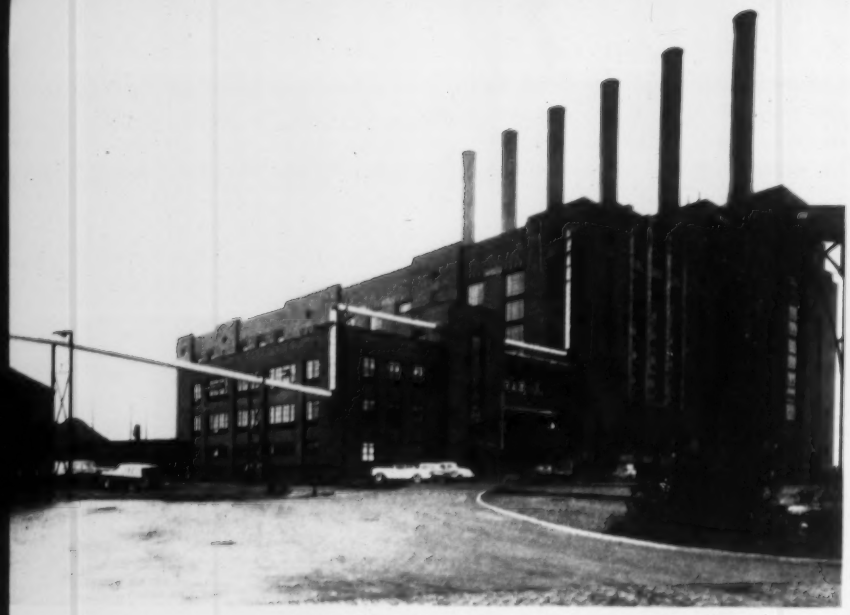
"'That thermostat on my wall shows a setting for 58 degrees,' he told me, 'but when I move it to 58, your system won't drop the temperature below 74. So it isn't working right.'

"I told him he wouldn't be comfortable if the temperature in his office were anywhere near 58 F, but got nowhere. I explained how thermostat dials were marked, and why, and that the thermostat itself doesn't create the temperature it controls. I pointed out that the speedometer on his car showed 120 mph, but that he didn't drive at that speed. (All he said was that he'd be a darned fool if he did. But he wouldn't say he'd be a darned fool if he sat in his office with a 58 F temperature.)

"I know this sounds silly, but it's a real problem that concerns me right now. I suggested that he call in some other consulting engineer of good reputation to survey the installation; if the other consultant says I am right, the owner is to pay his fee but if he says I am wrong, I'll pay it. My offer made no impression.

"So what do I do next, other than to go to court? I'd certainly welcome any aid and comfort other readers who may have faced as screwy a sales problem as this one can give me."

For obvious reasons, the consulting engineer who asks this question wishes to remain anonymous. He'll appreciate any suggestions on how to handle this "sales problem." . . . . . Perhaps you have also faced similar problems in your own work. Other readers would like to hear about them, and how you solved them. . . . . Please address your comments to The Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.



NEW INDUSTRIAL STEAM LINE supplies 390 psig steam from The Detroit Edison Co.'s Delray electric generating plant to a number of customers within 1½ miles. The 12 in. 300 lb steel line runs overhead for the first 1700 ft and is supported at some places by adjacent buildings and elsewhere by steel supports. The rest of the line is in conduit

District Heating Group Considers Futures For...

- *Steam for industry*
- *Improved controls*
- *High temperature water*
- *Coal pipe lines*
- *Atomic fuel*

BY JOHN F. COLLINS, JR.

Secretary-Treasurer
National District Heating Association

SERVING steam to industrial customers is not something new. It has been done in Indianapolis, Ind., and Rochester, N.Y., by the steam utilities at these locations and in Piqua, Ohio, by the municipality, as well as at other locations to a minor extent for a long time. However, when another of the largest and best known electric and steam companies changes its policy of more than 20 years and agrees to serve high pressure steam under a new rate to a number of industrial customers, some as far away as 1½ miles from the generating plant and with aging boilers, it is a mark of progress in the industry.

The commercial aspects of this move by The Detroit Edison Co. and a description of the line were presented at the recent 47th annual meeting of the National District Heating Association at Williamsburg, Va. Sterling S. Sanford's remarks on the new business phase were summarized in the July HPAC. The description of the new main prepared by Glen D. Winans, assistant general superintendent of central heating, and Carl W. Signor, supervising engineer, customers' steam service, is summarized here.

Mr. Signor said that for the first 1700 ft from the generating station, the 12 in., 300 psig steel line is overhead, supported at some places by adjacent buildings and elsewhere by steel supports. The remaining 6500 ft of line, partly 12 in. and partly 10 in., is in conduit. Some of the conduit is the company's standard concrete box, part is the usual solid pour type installed where there is danger of flooding, and the remainder is a solid pour conduit with special drainage features, installed where the ground water conditions are especially bad.

The pipe used is Schedule 40 in double random lengths. The only shutoff valve on the main is at its start in the plant, but each service is valved. These valves are 300 psig steel.

Steam at 390 psig and 725 F passes through desuperheaters in the generating plant before it reaches the main. As protection against water hammer, safety heads are set to rupture at 612 psig and 450 F. Expansion is taken up by slip type expansion joints. The line is covered with 3 in. thick calcium silicate and a waterproof jacket.

Condensate formed only at low or no flow is trapped in bucket traps. It is cooled by means of extended fin surface coolers and is discharged in cooling manholes beneath the normal water line to stop vapor from entering the sewer.

In another paper under distribution committee sponsorship, Paul L. Geiringer, president of the American Hydrotherm Corp., told of recent progress in district heating by means of high temperature water, in which heat is made available by a drop in temperature of the water without a change in its state.

In the original installation in 1950 at the Loring Air Force Base in Maine, steam was first generated in standard boilers, then converted in cascade heaters into high temperature water. In later installations, such as that at Lockbourne Air Force Base, forced circulation boilers without individual boiler drums were used. A dozen such plants are now in operation, and as many more are being designed or installed. Also, several universities have adopted high temperature water heating.

Mr. Geiringer said that such systems should be installed because they cost less to install, to operate, and to maintain and are equal in safety or even more safe than steam ones. He said that the Lockbourne plant is 80 percent efficient under operating conditions and that heat loss from a mile long 14 in. flow and return line at another installation is only 1 to 3 percent of the output.

By means of temperature entropy charts, he showed that more power can be produced utilizing turbine exhaust steam from high temperature water than from steam.

Concerning its use for district heating, the author said that would depend on whether or not the interest and amortization service of the additional investment for a two pipe water system increases the budget more than the possible savings in fuel and maintenance could reduce it. Another factor is the types of systems in buildings to be served.

This paper completed the distribution program headed by Jerome J. Collins of the Consolidated Edison Co. of New York, Inc.

Pipe Line Transports Coal

V. D. Hanson, mining engineer with the Pittsburgh Consolidation Coal Co., opened the program of the steam station engineering committee headed by Edwin C. Cawrse of The Cleveland Electric Illuminating Co. Mr. Hanson described the preliminary research and experiments carried on over a period of seven years before a coal pipe line was built between the Hanna mines of the Pitt-Consol coal interests at Cadiz, Ohio, and the Eastlake electric generating plant of The Cleveland Electric Illuminating Co. in Cleveland, a distance of 110 miles.

In 1949, as part of the general program to increase the efficiency of mining methods, the management of Pitt-Consol undertook to decrease the cost of delivering coal. At that time, hauls of 100 miles or more represented an astounding 50 percent of the total cost of coal to the consumer.

Mr. Hanson said that computations indicated that a pipe line carrying a coal water slurry offered the greatest potential savings. Experiments had been carried on as far back as 1891, but no satisfactory figures were available necessitating the determination of pressure drops and other criteria.

Cadiz was selected as the point of beginning of the line because there was a plentiful supply of coal there. The Cleveland Electric Co.'s Eastlake plant was chosen as its terminus because the utility, already purchasing a lot of coal, was agreeable to entering into a 15 year contract to buy 1.3 million tons per year at a favorable price, which was necessary to justify the spending of $2 million by the coal company to develop the pipe line.

A pilot system built in 1950 included a 1000 gal slurry tank, 200 ft of pipe line, and a centrifugal pump. A large scale demonstration plant followed in 1951, consisting of a 24,000 gal slurry tank and 2000 and 4000 ft pipe loops with slopes up to 20 percent.

The purchasing of land started in June 1955, following a survey, Mr. Hanson said. Line construction began three months later. It is to be completed this year. Trenchers laid the 12¾ in. O.D. line at the rate of 2 to 2½ miles per day in a trench 4 or more ft deep.

Included in the final construction are a slurry preparation plant and a coal storage area at Cadiz and a filter and drying plant in Cleveland.

Atomic Energy Discussed

The probable impact of atomic energy on district steam was evaluated in a paper on the steam station engineering program by C. A. Dauber, director of civil and mechanical engineering of The Cleveland Electric Illuminating Co.

Speaking on the economics of nuclear steam generation, Mr. Dauber compared the cost of a coal fired plant without superheaters, economizers, or air heater with the best available cost figures for a nuclear plant including an aqueous homogeneous thorium breeder reactor with a capacity of 100,000 lb per hr of steam. His conclusion was that the cost of generating steam by reactor would be $2.06, compared with $1.14 by coal plant. The present cost of fuel would have to increase 3.5 times to make a reactor competitive.

He felt that the impact of the use of atomic energy in industry will be greatest in those processes requiring heat. The change will not be revolutionary but gradual. The district heating industry, which has done little planning for atomic reactor use should do some long range planning to be equipped to use what may be its future fuel.

Another steam station program paper was presented by Theodore T. Peck, chief chemist, Polyphase Chemical Service, Inc., of New York. Mr. Peck said that in the early days of chemical control of combustion deposits 30 or 100 years ago, methods were of doubtful value and involved quackery. But now a chemical analysis of the deposits reveals their composition, and a study of the boiler discloses its operating characteristics, enabling the chemist-engineer to select the exact treatment required to get the best results. Thereafter, improved performance shows how much success has been attained.

A member of the NDHA's research committee, Homer F. Hatfield, atomic power engineer of the Penn-

sylvania Power & Light Co., spoke on "Atomic Reactor Plants in the Steam Heating Business." In his paper, he explored the possibility of using the steam producing part of atomic power plants in district heating.

He said that, so far, seven nuclear plants of four types, all designed to generate electricity and aggregating 700,000 kw of capacity, are under contract to be completed before 1963, and several others with a capacity totaling 200,000 kw are under consideration.

Of the five recommended types of reactors, he said, the pressurized water type about which the most is known is the most suitable to produce steam for district heating and could do so reliably after an experimental period.

Mr. Hatfield said that an investment of $10 million is at this time required for an atomic boiler with a capacity of 600,000 lb of steam per hr. This is $16.65 per lb per hr of generating capacity, much higher than the $8.35 for a stoker fired coal boiler and $2.70 for an oil fired boiler of similar capacity. Such a boiler is designed to convert 600,000 lb per hr of water at 240 F into steam at 400 psia.

His chart indicated that where the load factor is 30 percent in an atomic plant, the cost of fuel now may be 90c per M lb of steam generated. Later, with more experience, it may be decreased to 39c, compared with 31c in a coal fired plant.

Where the load factor is 100 percent, the cost of fuel now may be 79c per M lb of steam, decreasing in time to 30c, compared to 36c in a coal fired plant.

Save By Better Valve Control

In addition to the two Sterling S. Sanford papers reported in the July HPAC, the sales development committee, of which James W. Heaton, of the Philadelphia Electric Co., is chairman, presented a paper entitled "Economies Effected by New Valvatrol System" by Norman H. Davidson, sales engineer, Rochester Gas and Electric Corp.

The new system, said Mr. Davidson, consists of a pilot operating pressure regulating valve, with a solenoid valve added in the exhaust line of the pilot valve. Shutting of the solenoid valve closes the main valve, and vice versa. The opening time of the main valve can be varied over a wide range from a few seconds to several minutes to suit each heating system. The equipment combines the functions of a motorized valve and those of a pressure reducing valve.

Mr. Davidson enumerated the advantages of slow opening, including the practical elimination of water hammer, thermal shock, unequal expansion, and hunting or cycling, with accompanying noise and damage to the equipment.

Where the pressure differential is less than 15 psi, water or air pressure is used to operate the main line valve.

He said that 11 of the 12 Rochester installations have been in use less than a year, but all show savings and improved operation.

Discuss Control Devices

The commercial relations committee, whose chairman is Carl W. Signor, of Detroit, had three papers for presentation.

In the first of these, Henry W. Angelery, president of the Aerco Corp., manufacturer of water heaters, explained the characteristics of temperature and/or pressure operated steam flow controllers. He emphasized that the problem is a combination of effective control of heat transfer rates in the heater and proper response by the steam flow controller to effect a necessary change in both the pressure of steam in the coils and the quantity of flow. The controller must be capable of shutting off tightly for long periods and also of operating with either high pressure or low pressure steam supply.

In the second paper, Ernest C. Webb, of the Iron Fireman Manufacturing Co., described the operation of a forced circulation convection heater. Available in three sizes — 6000, 12,000, and 18,000 Btu per hr — the heater is designed for use with 10 psi steam. A feature of the heater is a steam turbine driven blower controlled by a mechanical thermostat which circulates warm air which passes through a filter.

In the third and final paper on the commercial relations program, Henry T. Kucera, president of the Automatic Devices Co., Inc., after reviewing the principles of heat loss from buildings and temperature control, explained the weakness of the simple manually operated time switch. He told of improvements to be gained in control by the installation of single or double time switches operated by outdoor temperature and the benefits of the interlocking system actuated by a combination of outdoor thermostat and system end thermostat. He drew attention to a spring attchment which makes a control system function for 30 hr if current should be cut off.

University Plant Keeps Growing

The Abbott power plant of the University of Illinois, when put in service in 1940, consisted of three 80,000 lb per hr boilers and two 3000 kw turbine generators operating at 325 psig and 650 F. Reporting on the past and expected future growth of the system, Gordon V. Carlson, superintendent of utilities, said that there has been a practically continuous growth since the beginning. At the present time, the installed steam capacity is 320,000 lb per hr, and the installed electric generating capacity is 15,000 kw.

He said that the university has predicted its future growth to 1975, and with this basic data a firm of consulting engineers, employed for the purpose, has advised the university to install at the proper times two 150,000 lb per hr boilers to operate at 875 psig and 760 F and two 7,500 kw turbine generators to operate at 850 psig and 760 F. They predicted that by 1970 the peak will shift from winter to summer, which may be prevented by the installation of steam absorption refrigeration units for air conditioning.

The second portion of the program

of the campus heating committee, under Chairman George K. Saurwein, who at one time was superintendent of the engineering department of Harvard university, was a round table discussion on whether it is best to use tunnels or conduits for steam lines.

Metering Improved

With the presentation of his report, William G. Gillim ceased to be chairman of the metering committee to become a vice president of the NDHA. His successor, Victor J. Bliemeister, of The Detroit Edison Co., presented the first of two papers included in this year's program of the metering committee. In it he explained a dual metering layout used by his company to measure the steam use of four industrial customers where the flow varies over quite a wide range. Two flow meters are used, one or both registering, depending on the load. An electrical control circuit automatically makes the necessary changes.

Mr. Bliemeister said that the basic idea is not new, but the arrangement of the piping and the type of controls used, which permits the elimination of a separate valve in the low range piping, is original.

The second metering paper was by James W. Althouse, Jr., of the Philadelphia Electric Co. In it the author described a field service test of a steam metering installation in which a linear primary metering element and a conventional orifice primary metering element were placed in series in a 2 in. steam line containing dry saturated steam at 140 psig.

Mr. Althouse said that previous laboratory tests made it seem desirable to conduct field tests to determine:

1) How service conditions would affect the calibration curve of the linear element.

2) How entrained solids or moisture in the steam affects performance of the linear element.

3) How the linear element performs in comparison with the orifice.

The steam load consisted of flow to the hot water generator and flow to replace losses from heating risers. The flow varied from 30 to 50 percent of the rating of the linear flow meter, being held within these limits until future tests.

Mr. Althouse said the meters were read simultaneously each week for 16 weeks. After needed adjustments, the ratio of registration became 1.06.

Upon completion of the field test, a calibration curve made in the laboratory showed a six percent shift, the result of a gasket partially obstructing the inlet chamber of the linear element.

He felt that design changes are indicated to improve linearity and service ability. Entrained solids, moisture, and condensate can be controlled. The linear element will perform as well as an orifice, he said. ‡

This article contains Part Two of the report of the recent 47th annual NDHA meeting. The first part appeared in the July HPAC. The report will be concluded in an early issue.

Package Units Provide Worker Comfort

. . . in world's first fully air conditioned men's clothing factory

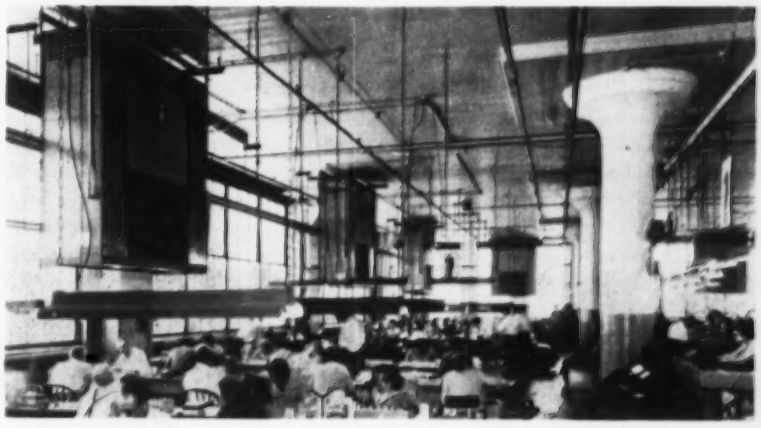
THE WORLD'S FIRST completely air conditioned men's clothing plant was recently dedicated in Philadelphia, according to the General Electric Co. Nearly $500,000 worth of packaged air conditioning equipment was used.

H. Daroff & Sons, Inc., manufacturers of Botany 500 and Worstedtex, employ 3000 workers.

Eighty-three water cooled packaged units are installed in the seven story, 210,000 sq ft plant. Most are of 15 ton capacity, although some are 5 ton. They are suspended on platforms hung from the high ceilings, permitting complete utilization of all the vital floor space below. Each unit is controlled by thermostat.

During the summer, 100 F temperatures were not uncommon in the factory, where hot irons and steam presses shape the woolens.

Each unit can absorb 150 gal of moisture from the air per day. This water is not re-used.

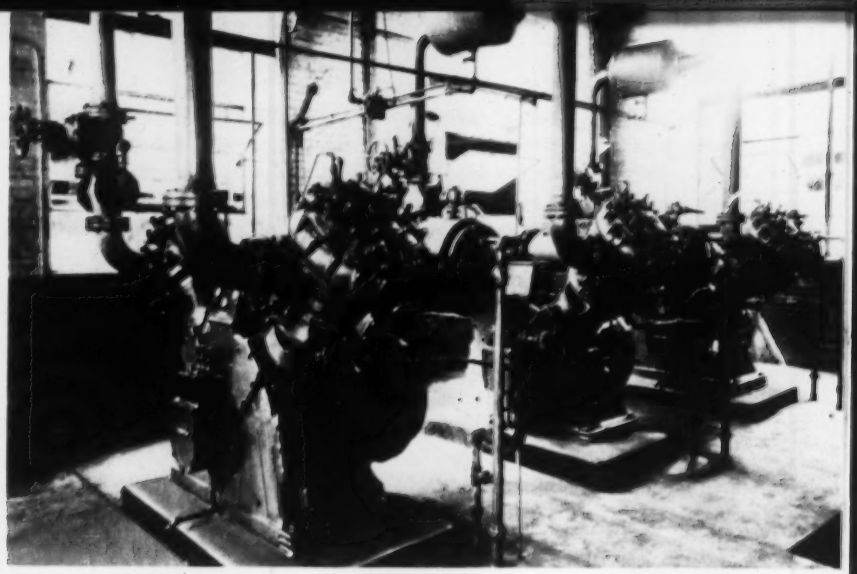


The installation makes limited use of plenums and no ductwork. The only ductwork is from corner units to windows for outdoor air intake year 'round.

All steam presses and piping are insulated with magnesia. Windows on the sun side are shaded by a tinted plastic coating to cut out 90 per cent of infra red rays and 88 percent of the sun's ultra violet rays.

A water cooling tower, 60 x 30 x 35 ft, is on the rof.

The air conditioning contractor was Republic Air Conditioning Co., of Philadelphia. ‡



1 VERTICAL COMPRESSORS arranged in line form an ideal grouping. Common water supply pipe line under floor serves all three, and intercooler water outlet pipe lines, also on the same side, empty into a common drain

How To Design Air Piping for Grouping Air Compressors

. . . *to save on equipment cost and floor space*

The author gives 10 advantages of grouping compressors and reviews the main factors in choosing the right location, allowing adequate space, insuring a firm footing, sizing suction piping, designing distribution piping, and centralizing controls.

BY W. H. VEDDER

Application Engineer
Compressor Div.
Worthington Corp.

How should air compressors be grouped, and what are some of the factors to consider? Each particular plant operation may well dictate an answer to this question. If, however, you are undecided as to how to proceed, there are certain factors that should be considered.

What Are the Advantages?

The following factors have given strong motivation towards this type of installation:

1) Minimum number of operators are required. One well trained operator can run several compressors with better operational results.

2) Centralization of maintenance tools, spare parts, and crane facilities. Why duplicate these for each compressor installed in your plant?

3) Minimum number of service lines such as water, electricity and air.

4) Saving on installed accessory cost possible. One large aftercooler and/or receiver can serve two or more compressors. If a cooling tower or other such closed cooling water system is used, only one large heat exchanger need be provided.

5) Easier and closer control of air pressure by integrating unloading steps. For example, two compressors each with five step control can together provide 10 step control.

6) Lower installed cost for foundations by tying foundations together into a common mat. This is not only generally less expensive, but usually results in a more stable foundation than one foundation per compressor.

7) Operating sounds and hazards of rotating machinery located away from production personnel.

8) Standby capacity is economically installed.

9) If a change in production facilities occurs, only piping need be moved, not complete compressor installation.

10) "Stacked" arrangement enables more efficient use of floor space for maintenance of adjacent compressors. The same space between compressors can be utilized for work on either machine.

Determine Location Carefully

Ready access to an adequate supply of clean cool air is essential for any central location. The most logical location would be in the powerhouse. Here qualified operators should be available who are familiar with power generating equipment.

By standardizing on a minimum number of compressor and accessory sizes the initial investment will be

decreased, and quantities of spare parts to be stocked, reduced.

A definite maintenance and inspection program can be followed if sufficient standby capacity is provided to allow one unit to be shut down. Sufficient space should be allowed around each unit to carry out this program effectively. Piping should be either elevated or laid out in trenches to further facilitate inspection and maintenance. Provision for crane service to handle large parts will be another factor in efficient upkeep.

The exact location of the compressors in the plant should be determined by having each department estimate its present and further needs, and then determining the point in the plant which will supply the necessary air with minimum piping loss.

Allow Adequate Space

One of the first problems to be solved when grouping compressors is the physical arrangement of the machines. This will be largely determined by the shape of the space available.

When the space is rectangular, vertical units arranged in line, as shown in Fig. 1, are ideal. The water lines for the unit are located so that a common pipe beneath the floor supplies all three units, and the intercooler water outlet lines are also on the same side and empty into a common drain under the floor. Also notice the large window area giving abundant light and the ample space for maintenance.

Three units grouped to take advantage of a square space are shown in Fig. 2. Note that there is room for a fourth unit if necessary.

The most common arrangement of a group of four horizontal duplex units is shown in Fig. 3. An ideal arrangement of four balanced opposed units is shown in Fig. 4.

When the actual layout is made, consideration should be given to allowing enough space around the units to permit observing all parts of the unit when in operation, and the possible removal of parts such as pistons, piston rods, and cooler nests without interfering with other units or the building walls.

Insure Firm Footing

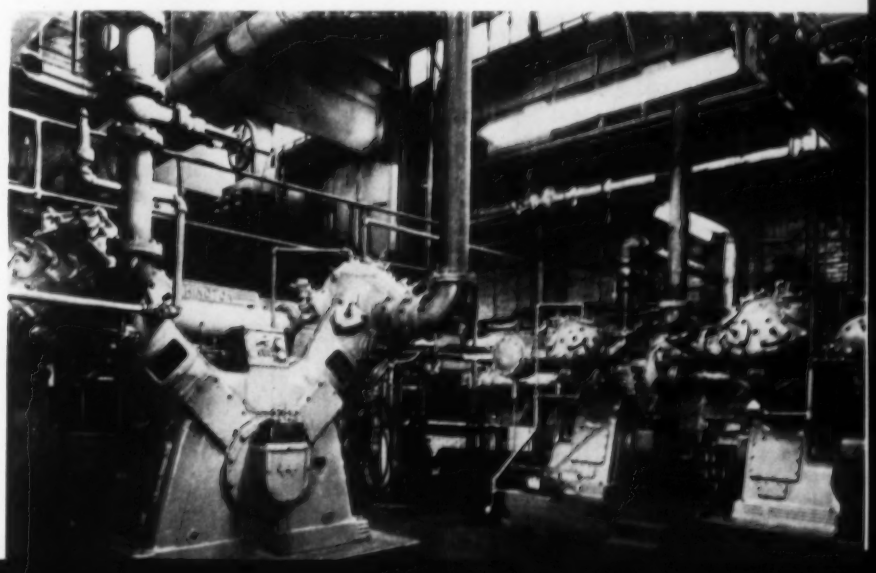
The foundation under the units should be carried down to a good firm footing. It is generally advisable to isolate the foundation from any building footings, walls, or floors to eliminate vibration problems in adjacent areas. With a grouped arrangement the foundation for all units should be cast enbloc, or if they are cast separately, they should rest on a common mat.

How To Size Suction Piping

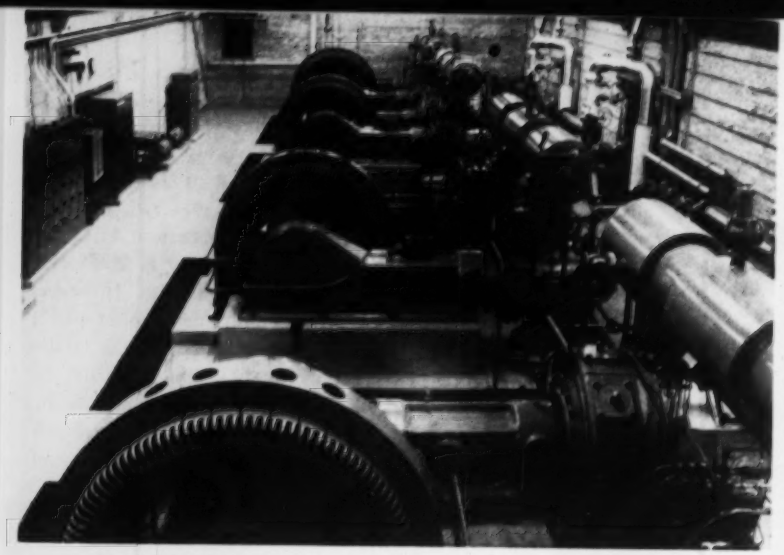
The function of the suction pipe is to provide the compressor with a good, clean, dry, cool supply of air. The cooler and drier the air, the lower the horsepower and the greater the actual capacity. If a unit capable of delivering 2000 scfm — scfm is measured at 14.7 psia, 60 F and dry — is required, and the actual suction temperature is 80 F, the capacity at intake is 2030 cfm to supply the 2000 scfm. However, if the temperature is reduced to 75 F at suction, the capacity at intake is 2060 cfm to give 2000 scfm. In both cases the gas is assumed to be dry. If in case one the gas were still at 80 F and a relative humidity of 100 percent, then 2155 cfm at intake would be required to produce 2000 dry scfm.

In Case 2, if in addition to the temperature being reduced to 75 F, the relative humidity were reduced to 50 percent, the capacity at intake would be 2095 cfm to produce 2000 scfm. Where individual intake lines and filters are used for each unit, the diameter of the pipe must be equal to or larger than the connection of the cylinder. The size should be increased 1 in. in diameter for every 10 ft in length measured from the compressor. When a common pipe is used to supply several units, care must be taken to assure that the velocity in the pipe does not exceed 2000 to 2500 fpm. In addition, the size should be ample to provide the necessary capacity so that the pipe or header is not undersized with resulting pulsations. The filter on a common suction header should be large enough to effectively handle the large flow.

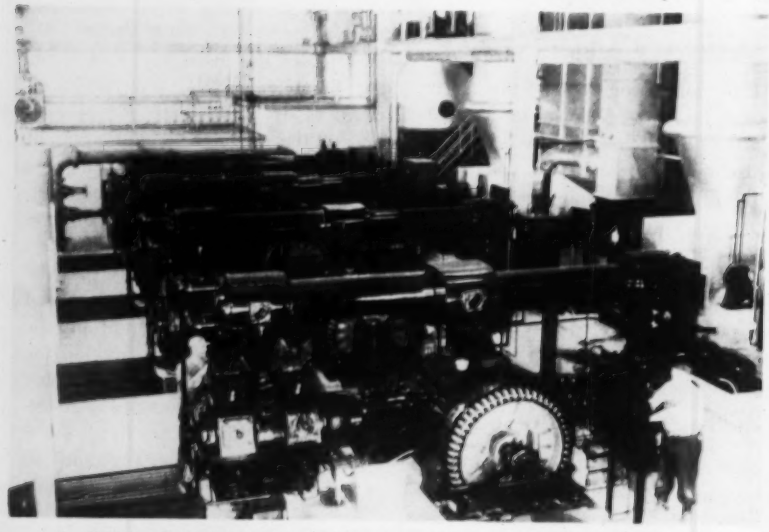
A group of single stage, two cylinder, nonlubricated duplex units with



2 THREE UNITS IN SQUARE SPACE may be grouped as shown here. This arrangement allows room for a fourth unit if necessary



3 MOST COMMON ARRANGEMENT of four horizontal duplex compressor units is this one in adequately sized rectangular room. Note control center at left



4 FOUR BALANCED OPPOSED UNITS are ideally grouped here. Abundant lighting, and space around units permits observing all parts in operation and facilitate maintenance.

a common suction pipe for the two cylinders is shown in Fig. 5. Note drain valve on bottom of pipe, and safety valve in discharge line. All of the units face the same way, so that the space between the wall and the cylinder head is available to pull the heads and pistons if necessary. Ample space is provided between the units to allow easy access.

Use Loop Distribution System

Many engineers overlook the fact that the final discharge or distribution system is one of the most important elements of the compressed air plant. Pressure drops between the compressor and the point of usage represent money being wasted.

The pipe sizes should be large enough so that the drop between the receiver and point of use will not be over 10 percent of the discharge pressure.

Reducing pipe sizes is false economy. The initial cost of the pipe varies only slightly, and cost of installation labor is practically the same. Consideration should be given in selecting pipe size to future needs for air. For example, if a system consisted of two 2000 cfm compressors, and the discharge pipe for the two units is 10 in. in diameter, the pressure drop would be about 0.28 psig per 1000 ft of pipe based on 100 psig dicharge. Now if a third 2000 cfm unit were added, based on the same 10 in. pipe, and 6000 cfm flow, the drop would increase to approximately 0.64 psig. Had the pipe originally been 12 in., the drop basis for 6000 cfm would be 0.24 psig.

. . . when possible

Wherever possible the loop system should be used for air distribution since it allows a two way path to the point where demand is the greatest. When such a system is used, care must be exercised to be sure that adequately sized receivers are located near the ends of the system or at points where there are intermittent heavy demands.

In addition to the above points, consideration should be given to see that pipes are adequately supported, clean of rust and scale, and that they slope away from the compressor. Low points or large volumes such as headers should be adequately drained to prevent condensation and collection of oil, moisture, etc.

Compressor Services Important

The two main services which are necessary and which must be considered in a group arrangement are cooling water and the prime mover energy such as electricity, steam, or engine fuel. Cooling water is important, and should be as clean as possible to give higher cooling efficiency and reduce downtime due to dirt deposits in the jackets.

If the drive is electric motor, it is possible that the electrical distribution system in your plant will be such that a packaged motor center can be worked out to allow centralization of the controls, or else the breakers and transformers can be located in a substation and motor control cubicles used at the motors themselves.

use the loop system of air distribution

Operators will appreciate the convenience and safety features of centralized control grouping and will respond with more frequent and closer checks on operating characteristics. Such control grouping might well include protective devices including indicating lights or warning horns for low oil pressure, high bearing temperatures, high discharge air temperatures, and other conditions. It is well to locate other gages and instruments at this central station, such as pressure gages, temperature indicators, and the like.

Several practical control systems avail themselves with a grouped arrangement. For peak load conditions a start and stop system can be used wherein one or more compressors are started automatically when the pressure falls. Proper engineering can incorporate this into a lead-follow system which utilizes one or more compressors to carry the base load while one or more machines float on the line, loading or unloading or starting and stopping, as the system demands.

By a simple setting of a transfer switch, or re-arrangement of a plug-in system, the sequence of operation can be varied so that each machine can act as the base machine, thereby spreading the wear over all the machines.

TABLE 1—DOLLAR SAVING of 9 percent on installed equipment and 40 percent saving in floor space would result from grouping three 1000 hp compressors rather than installing five 600 hp units in separate parts of a plant requiring 16,000 cfm of installed air capacity

	Grouped Arrangement	Disbursed Arrangement
Number of compressors required	3	5
Total motor horsepower	3000	3000
Actual capacity, cfm at 100 psig discharge	16,000	16,000
Cost of equipment		
Compressors and motors	$211,552	$225,508
Suction filters	1,455	1,548
Aftercoolers and separators	10,603	12,007
Receivers	5,828	6,078
Exciter MG sets	4,056	6,155
Magnetic full voltage, synchronous motor starters	8,646	12,909
Equipment costs, total	$241,920	$265,785
Foundation costs	$ 7,524	$ 8,580
Equipment and foundations, total	$249,444	$272,365
Floor area (required, sq ft	549	1340
KW per 100 cfm of actual capacity	15.95	14.02
Cost per cfm of actual capacity*	$15.60	$17.04

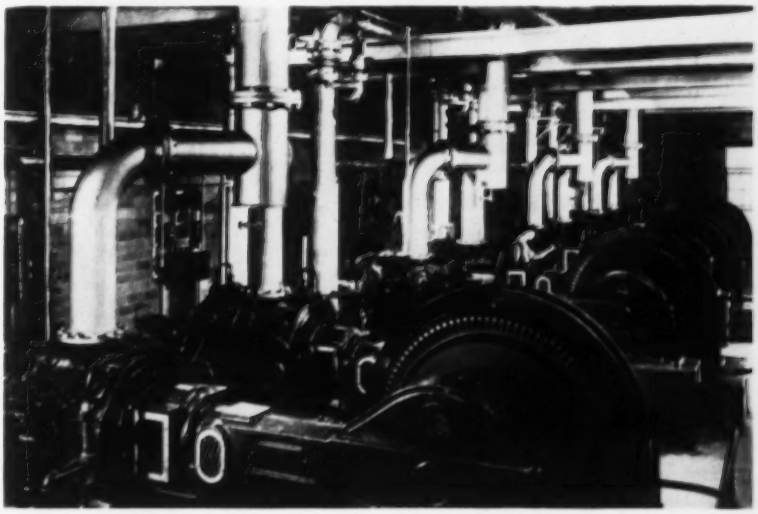
**Based on equipment and foundation only. Does not include labor or installation costs.*

Look at Dollar Saving

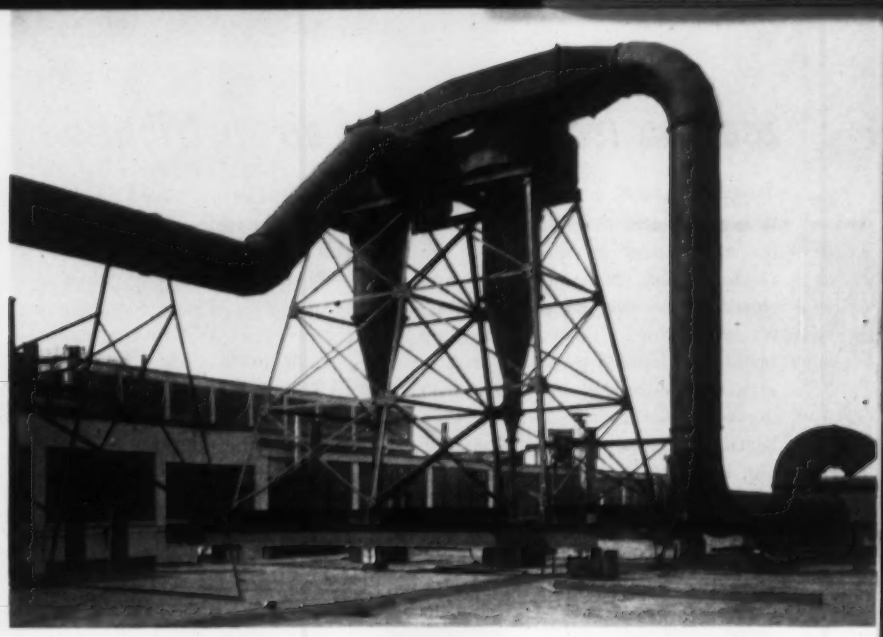
By looking at the dollar saving on the initial cost of the equipment alone, one should be convinced that grouping of compressors is advantageous. Table 1 is based on two stage water cooled compressors with a plant air requirement of 16,000 cfm installed capacity. The motors are three phase, 60 cycle, 2300 volt, unity power factor. The initial capital investment, power requirements and floor space for a group arrangement of three 1000 hp compressors is compared against a similar study of five 600 hp units, each installed in a separate part of the plant. Note the saving of better than 9 percent on installed equipment cost alone, and a 40 percent reduction in floor space for the grouped arrangement.

Operating cost of the centralized location are lower due to the higher motor efficiences of the larger motors.

Another important fact is that group arrangement requires only 15 major items of equipment against 25 in the separate unit arrangement, meaning fewer items to intsall and maintain.



5 COMMON SUCTION PIPES each serve two cylinders of these duplex units. Units are single stage, two cylinder, nonlubricated type; note all face same way



DUST COLLECTOR INSTALLATION on auto plant roof was shop fabricated, like all other jobs by Spitzley-Rettenmier. Exhaust system design is covered in first few classes of journeymen's sheet metal course each year

Journeymen Sheet Metal Workers

Annual refresher courses train men in ventilation and air conditioning design theory for better sketch making. Increased efficiency and production, less scrap waste, and project foremen that know "why" as well as "how" are reasons that training is of "immeasurable value."

BY WILLIAM J. RETTENMIER
Vice-President
Spitzley-Rettenmier Sheet Metal Co.

THIS FALL another group of our journeymen sheet metal workers went back to school again. Special courses, held annually, are paying off for both employees and the company. Journeymen increase their knowledge and skills, work is speeded up, and both time and material are saved.

The courses were started four years ago to meet changing requirements for fabrication and erection, especially the newly recognized jurisdiction of journeymen making shop drawings or sketches.

Organized in 1937, our company centered its activity on the fabrication of industrial and commercial sheet metal specialties and the fabrication and erection of air conditioning and ventilation systems. The firm which presently employs over 150 journeymen sheet metal workers, has installed systems in many large projects in the Detroit area, including the City-County building, Ford hospital, various large installations at the Ford Technical Center, the General Motors Technical Center, and others.

Journeymen Have Jurisdiction

Some of these projects require as much as 100 tons of sheet metal. Since all fabrication is done at the plant, with only incidental fabrication at the job site, it is obvious that accurate shop drawings are a prime requisite. Until 1949, making shop drawings or sketches for use by journeymen sheet metal workers in their fabrication and erection activities had been ignored in the Standard Form of Union Agreement between Employers and many local Unions. In 1949 a new Standard Form of Union Agreement was adopted and subsequently revised in 1955 in which the jurisdiction over making these sketches is spelled out:

"Article 1, Section 1: This agreement covers the rates of pay, rules, and working conditions of all employees of the Employer engaged in the manufacture, fabrication, assembly, handling, erection, installation, dismantling, reconditioning, adjustment, alteration, repairing, and servicing of all ferrous or non-ferrous sheet metal work of No. 10 gage or its equivalent or lighter gage, and all other materials used in lieu thereof, *all shop and field sketches used in fabrication and erection, including those taken from the original architectural and engineering drawings or sketches* and all other work included in the jurisdictional claims of the Sheet Metal Workers International Association.

"Article 2, Section 1: The Employer agrees that *none but Journeymen Sheet Metal Workers and Registered Apprentices shall be employed on any work described in Article* 1."

This did not present any particular

AIR SUPPLY DUCTWORK for a large office building, shop fabricated on a production basis, required only incidental fabrication at the job site. Good fitting ductwork, with very little scrap, is one of many benefits of journeymen's special training

Go to (Company) School Again

problem to our firm since we had several years prior to 1949 changed our method from field fabrication to shop fabrication to provide greater efficiency and had trained several journeymen to make these drawings and sketches. However, quite frequently, fitting designs submitted had to be changed because the use of such a design would be poor engineering practice. We decided that these journeymen should be given an opportunity to learn why it was necessary to design this way or that way and what procedure should govern these choices of design.

So we began to hold classes in ventilation and air conditioning engineering for our foremen only. Classes start in September and are held biweekly until well into spring.

Textbooks, Lectures, Problems

Since the various elements entering into the design of an average air handling system are more dramatically portrayed in an industrial exhaust system, the first few classes each year are devoted to exhaust design. The various resistance pressures occurring are explained and illustrated, and the pressure losses in various types of fittings, entrances, etc., are studied. For this, we use as a textbook "Industrial Ventilation," the manual of the American Conference of Governmental Industrial Hygienists.

We then begin to work out problems of design, and some of these are given to the students to work on at home and are subsequently discussed in class. Later, supply systems are discussed, and problems in design of conventional supply systems are worked out. Outside authorities on some special phase of the profession are brought in to give talks on such subjects as "Fan Laws and Performance," "Sound," "Controls," etc. We like to have three or four of such talks during the winter. This year we plan to spend some time on dual duct systems, since we have done several jobs using dual ducts in the past three years.

We furnish each man with the latest authoritative textbook relating to each subject. We do not allow anyone to use a slide rule because we wish each student to have a thorough knowledge of the mathematics involved. All students are required to be able to solve square and cube roots mathematically. Their solutions must be calculated and presented neatly in class and they must demonstrate their solutions on the blackboard and explain why they did what they did.

How the Course Pays Off

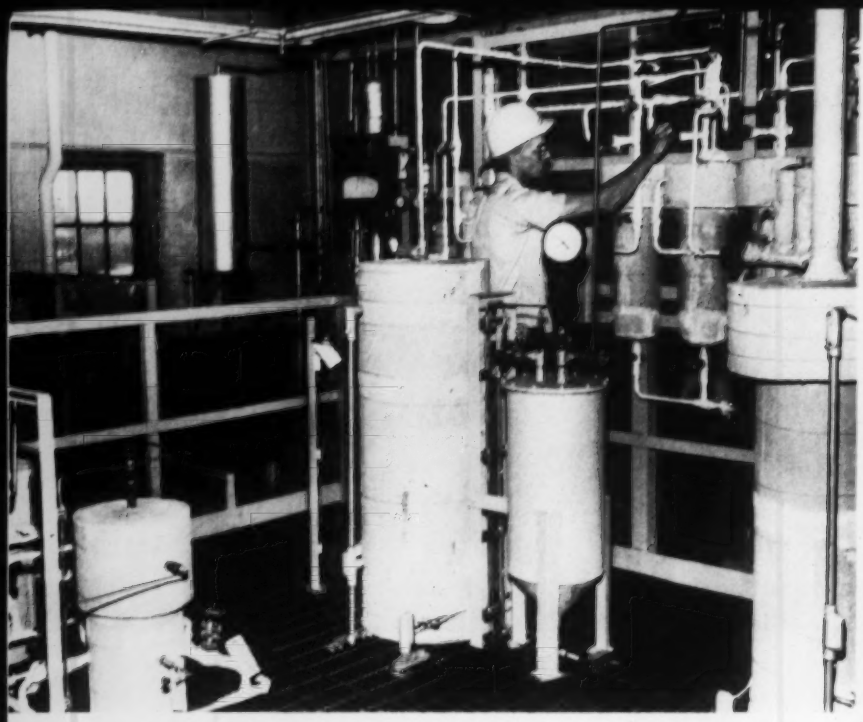
Today we have 12 journeymen who have had this course at least two years, and some three. It has been of immeasurable value for many reasons:

1) The ductwork fits and we have very little scrap.

2) The shop fabrication can be put on a production basis.

3) The project foreman can talk the language of the owner's engineer; he does not have to call the office to send out an engineer to answer the average question.

We are thoroughly convinced that whatever time and effort may be put forth on this project, the results more than justify the expenditure. It has been a standard practice in many European universities to require engineering students to obtain actual shop practice in various trades to which their engineering will be applied. We are just reversing the process here. ✠



CRACKER PILOT PLANT, with reactor, right, catalyst supply hopper and regenerator, center, and fractionating column, left foreground, on this upper level, was designed as small as pipe and tubing allow for handling process

Stainless Steel Piping Model Provides Refinery Answers

. . . New welding techniques used. Radioactive tests of all welds made

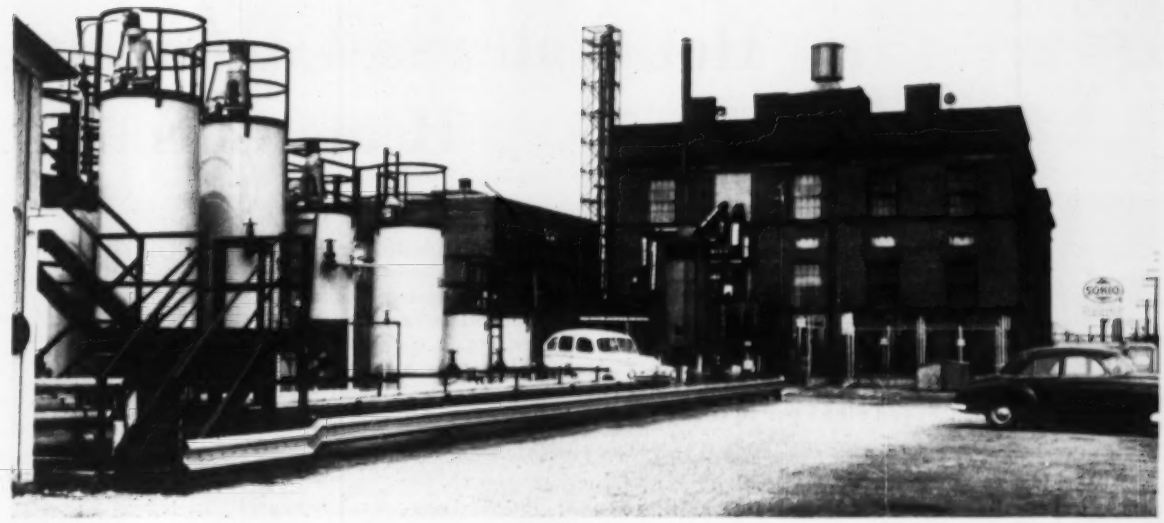
WHEN Standard Oil Co. of Ohio's (SOHIO) newest catalytic cracking unit went on stream about a year ago, SOHIO officials weren't holding their breaths in anticipation of new production records. The new unit would be lucky to squeeze out more than 1 bbl per day of refined product.

But this didn't come as a surprise. SOHIO had planned and designed the new catalytic cracking unit in "Tom Thumb" proportions for just such a capacity. Actually, the new unit was designed and built by SOHIO's process and product development personnel at their Cleveland laboratory to simulate operation of the company's Lima, Ohio, catalytic cracker on a scale that would permit extensive experimentation and analysis for improved production.

Ever since the Lima unit began operation, refinery engineers have been concerned over the impracticality of experimenting with a full scale refining unit to adjust refining process variables for optimum production from various gas-oil feed stocks. With a 33,000 bbl per day throughput they found the continual operation required by production demands didn't permit the necessary freedom to perform such experimentation. Also in some instances, such experimentation could prove to be costly due to the possibility of shutdowns from operational upsets. Yet they felt that quality could be substantially improved by an adjustment of temperature, space velocity, pressure, catalyst to oil ratio, or recycle ratio according to the particular feed stock.

An ideal practice would be to run a batch of feed stock through the refinery, altering variables to determine the best operating conditions for the feed stock being processed. With the "Tom Thumb" unit, they can do just that, under actual refinery conditions and on a small scale, down-to-earth, practical basis. Initial operation of the unit for their study of feed stocks has already revealed some new facts and information.

The miniature refinery unit is for all practical purposes a copy of the catalytic cracking unit at Lima. Some modifications were naturally made due to size or equipment limitations. Catalytic cracking of petroleum is accomplished with a silica-alumina catalyst in a circulating solids system. The "Tom Thumb" pilot plant is a



MINIATURE TANK FARM stores the gas-oil feed stock brought in from full scale refinery prior to processing through "Tom Thumb" refinery. Mechanical mixers on tanks assure homogeneous blending of feed charge to cracking unit

complete operating unit including extensive instrumentation and a miniature tank farm. Samples of the various gas-oil feed stocks to be processed at Lima are stored in a model tank farm and then piped over to the pilot plant for processing.

Perhaps one of the greatest problems in designing a full scale refinery in miniature was the practicality of materials and equipment on this reduced scale. If they designed on too small a scale, pipe and tubing would be unable to handle the liquids in process, or operating equipment was unobtainable; if too large, the whole project would get out of hand. The final design was the result of a lot of study and planning that more or less hits the middle of the road as for size and does everything they had hoped for.

Fabricate Piping in Shop

Once the design and engineering details were worked out, the company decided to utilize an outside service for the specialized fabrication of all process equipment and erection of the entire pilot plant. Dravo Corp. acted as prime contractor-fabricator and worked closely with SOHIO in the development of the unit.

All of the process equipment proper was fabricated from Schedule 40 stainless steel with carbon steel being utilized for components. Prefabrication was done in the contractor's plant so that the materials could be handled with specialized shop welding equipment and controlled techniques to meet some of the more exacting requirements of stainless.

Use New Welding Technique

A new technique was employed in the welding phases that eliminated the use of the conventional backing ring. With this technique, a full, uniform penetration of weld was achieved without overhangs, icicles, or crevices that could cause turbulence in flow and affect process results. All shop fabricated materials were inspected with special radioactive testing equipment capable of detecting flaws in welds up to 4 in. wide.

The gas-oil charge stock is brought in from Lima and stored in a model tank farm to be withdrawn according to test requirements. After leaving the tank farm, the feed stock is first weighed, then piped to the charge preheater, then into the reactor section where the gas-oil feed breaks down into smaller molecules for further processing. From the reactor, the vapors are cycled through a condensor, separator, and on to the fractionating towers.

The spent catalyst flows through a steam stripper, then into the catalyst regenerator where it is reactivated.

Preheat Oil As Necessary

After the petroleum hydrocarbons leave the separator, they are preheated as necessary and processed through the three stainless steel fractionating towers: the first tower produces butane or propane; the second, gasoline; the third, light and heavy gas-oils, part of which may be recycled as required.

Control of the pilot plant is completely automatic through the use of standard process instrumentation. The maze of tubing proved to be a real pipe fitter's nightmare in the actual tying in of the process lines with equipment and instrumentation on such a small scale.

Initial operation has been on a 1 bbl per day basis. Although it is too early to determine an accurate payout, SOHIO feels that the unit will prove to be a very important tool in improving catalytic cracking operations.

Hot Water in Continuous Heats Cornell's

To provide economy and efficiency, each building is divided into three zones. Hot water convertors use steam from the university's underground distribution system. In addition to continuous perimeter radiation, miscellaneous standard convectors heat entrances, lobbies, etc. A special heating and ventilating unit with a steam coil serves a large snack bar which seats 300. Total cost of the heating system averaged $0.65 per sq ft of floor area.

BY ARTHUR L. ZIGAS

Mechanical Engineer
Chapman, Evans & Delehanty
Architects & Engineers

WHEN Cornell university built six new men's dormitories at Ithaca, N. Y., one of the primary requirements was an economical and efficient heating system. The building construction is flat plate concrete slab with limestone aggregate block and brick cavity exterior walls and painted limestone aggregate block interior partitions. In general, all concrete columns are 11½ in. square.

After preliminary studies, it was decided to use a hot water heating system with continuous finned tube perimeter radiation. Steam supplied by the university through an underground 50 to 60 psig distribution system is reduced as required in each building. Low pressure steam is supplied to a domestic hot water tank heater and a space heating hot water convertor. Condensate is metered and

SIX NEW DORMITORIES high above Cayuga's waters each have a heating load of 1.5 million Btu per hr at −15 F. Ingenuity of design provided simplified piping and economical, tamperproof installation

Finned Tubing New Dorms

returned by gravity in three buildings and pumped out of the other three into the university distribution system.

Each Building Has Three Zones

To provide simplified piping and economy of installation, each building is divided into three zones: bedroom area, student lounge, and social lounge. Continuous radiation is run along each wall with 12 main risers for the entire building. Corridor radiation is installed as separate serpentine risers so as not to run tubing along the inside walls of the end bedrooms.

For ease of balancing, a reverse return system is employed for each pair of risers, with all return risers collected in the attic. An enlarged chamber is provided in the main return header at the point where the main drops down in the attic. This chamber provides for reduced water velocity and main air venting. Except for small miscellaneous vents on the lower floors required for door looping, etc., the attic vent provides for the main release of entrapped air.

The continuous run of finned radiators between each supply and return riser is provided with nonrising gate shutoff valves and a balancing fitting. Nonrising stems permit the use of standard solder-end valves within the continuous finned tube enclosure. All access to valves is by means of tamperproof screwed plates. To avoid offsetting the tubing around the exterior columns and to allow for straight runs, extra heavy steel pipe sleeves were inserted in the columns during construction. Because of the small size of the column, these sleeves were detailed on the structural plans and installed by the construction contractor. Out of a total of 736 column sleeves, only one sleeve was omitted and two improperly placed.

Avoid Student Tampering

Due to the straight restricted run between risers, expansion of the tubing presented somewhat of a problem. Packless bellows type expansion joints which were available at the time were considered to be a maintenance problem and subject to student abuse. With their limited traverse, over 300 expansion joints would have been required. A vertical circular loop was specially designed and fabricated to fit within the limited space of the enclosure and tested for flexibility by a copper tube manufacturer. It was found on test to be unsuitable and a vertical inverted U-bend expansion loop was then investigated. One loop per run was installed to occur at a column with a higher sleeve so that only half the loop appeared in one room. In order to avoid installing a vent at each of the 130 loops and invite student tampering, the loop tubing was reduced one size to maintain a higher water velocity and carry over any entrained air.

Miscellaneous standard convectors in entrances, lobbies, etc., are taken off the main with diverting fittings. Over 1200 lineal ft of finned tube was required for each building, with 2400 lineal ft of connecting tubing and mains. The total heating load in each building at −15 F is 1.5 million Btu per hr.

How System Is Controlled

Hot water at 240 F is circulated at the rate of 150 gpm by a single pump. Because of the parallel grid

FINNED RADIATION is continuous with the perimeter. Note half of typical vertical inverted U-bend expansion loop

layout, total pumping head is only 15 ft of water. Water temperature leaving the convertor is maintained at 240 F by a temperature controller operating a convertor motorized steam valve.

The bedroom zone is controlled by an outdoor reset type control operating a three-way mixing valve to adjust the zone water temperature in accordance with outdoor temperatures. A time switch provides night setback, and a second outdoor controller provides variable morning pickup. The student lounge and social lounge are controlled by room thermostats operating two position motorized valves. Pump operation is continuous whenever outside temperatures are below 65 F.

In one building a snack bar seating 300 students is handled separately with a special heating and ventilating unit. A steam coil is controlled by a room thermostat through a discharge low limit controller. The heating and ventilating unit is interlocked with the kitchen exhaust fan to provide adequate outside air makeup.

All toilet rooms, regardless of fenestration, are mechanically ventilated as a matter of good maintenance.

The unit cost for the heating system, averaged over the six buildings, was slightly over $0.65 per sq ft of floor area or a little over $0.08 per cu ft.

Jamieson-McKinney Co. was the heating contractor. ✦

Practical Piping Problems

BY CARL DOPP

How *Not* to Test Quick Operating Brass Gate Valves

Water hammer in a crude test rig subjected valves to 1000 psig when a column of water flowing at maximum velocity to atmosphere was shut off in a fraction of a second. Certified nonleaking valves were made to leak badly and, hence, were thought to have been defective. Upon investigation, further 'testing' was suspended until "air chambers or some suitable shock absorbers" could be installed in the test rig.

JIM WILSON, manager of the complaint department of Graybourn Valve Co., dropped into the office of George Morten, chief engineer, to discuss what appeared to be a rather serious complaint.

"More trouble, Jim?" George asked.

"Yes," replied Jim, "this is a tough one and I'm not sure that your engineer, Walter Spring, is sizing it up properly."

"You know, Jim, that Walt is one of our best development engineers. He has done a fine job on many serious problems. Now just what's the nature of this complaint?"

Jim explained. "The Hoefler Oil Co. has been buying many quick operating brass gate valves, principally for use on the flexible hose lines of the tank wagon loading racks. Recently they returned six of these valves which were very bad leakers. They said that none of these had ever been placed in service."

"Jim, let's get Walt in here and have him explain what he's doing about this customer's trouble."

Why the Valves Failed

In response to a phone call, Walt came into George Morten's office.

"Sit down, Walt," invited George. "Tell us what you are doing about the Hoefler complaint on quick operating brass gate valves."

"Well", replied Walt, "it's my opinion that the six valves returned by the customer have been subjected to extremely high pressure for such a valve. I would say that the pressure must have been close to 1000 psig."

"How did you arrive at such a conclusion?"

"First, the valves must have been tight at 80 psig air pressure before shipment or they would never have passed our inspection department. The valves, as returned, were unquestionably leaky, as it was possible to see daylight between the seating surfaces at the top of the wedge disc when the valves were closed. By way of a further check, we used the regular shop gage for the body seats. This clearly demonstrated that the seating surfaces in the body had spread apart at the top as much as 1/32 in. This could have happened only if the body had expanded and taken a permanent set. As you know, the design is such that there is a wide surface extending beyond the seating surfaces to make room for the valve disc when it is swung to open the valve. This makes that part of the valve body the weakest section and, therefore, the first part to give under excessive pressure. The seating surfaces, being integral with this part of the body, will naturally spread if the body expands. The design is such that I don't believe such a result could have occurred unless the pressure was somewhere near 1000 psig."

George agreed. "That analysis sounds reasonable, Walt, but what are you doing about it?"

Stamp Secret Mark on Valves

"I've had six regular stock valves retested on air at 80 psig in my presence. They were all bottle tight. We stamped a secret mark on each valve so it could be recognized if it came back. It's my plan to send these valves to the customer as replacements, and to ask that they be returned if they show leakage."

"Just what do you expect to gain by that?" asked George.

"Although I feel confident that my theory about blowing up the

The author writes from a wide and versatile background in the design and application of valves. Before retirement, he spent 45 years in the engineering department of Crane Co. For 15 years he spent much time in trouble shooting. Later, he was directing engineer of the valve and fitting engineering department for 18 years.

valves by high pressure is correct, I discussed the matter with our general superintendent. He seemed to agree with me, but admitted it might be remotely possible that something had gone wrong in the factory, and some improperly machined valves had gotten through. We decided that if we sent six more valves that we both knew were perfect, we might get proof as to whether the customer or we were to blame. His theory is that if the valves are accepted as satisfactory, we had to admit that the customer was right. If, on the other hand, the valves come back in the same condition as the others which were returned, then the customer is doing something to the valves which he has not revealed to us. In that case, someone would have to visit the customer's plant and hope to discover what is wrong."

Jim, who had been listening attentively up to this point, injected the suggestion that it might be better if Walt visited the plant in an effort to learn the cause of the trouble. George leaned back a few moments, then responded: "We'll ship the six replacement valves. If they're damaged, Walt will make a personal investigation. Let's leave it at that for the moment. Jim, you ship the valves and keep us posted."

Found New Valves Just as Bad

A few days later Jim received a long distance call advising him that the new valves had been tested and were just as bad as the previous lot. A quick session in George Morten's office soon found Walt Spring eager to start for the trouble spot.

Next morning, Walt introduced himself to Hoefler Oil Co.'s superintendent, Fred Schneider, and explained his mission. It was obvious that the customer was quite upset about his valve trouble but more than willing to talk about it with Walt.

In the course of the conversation the superintendent remarked that it looked to him as though the factory had let down on the quality job they had been doing on these valves in the past.

Walt asked, "When did you first discover this trouble?"

"Let's see," replied Schneider, "I think it must have been about the time we started testing all valves for tightness before installing them. We had several cases where valves of various types had been installed and then had to be replaced because of leakage."

"I realize how you feel about this," said Walt, "but would it be asking too much to let me see a few new valves tested in your regular manner?"

"No, I'll cooperate in any way to get this thing corrected."

Inspect Test Procedure

The test rig was rather crude. It consisted of a pipe coming from the floor below through an elevator shaft. About 5 ft above the floor it was bent about 90 deg to be parallel to the floor. There was a regular brass gate valve in the line. In front was a large open tank into which the discharge from the test valve could flow.

The valve to be tested was screwed onto the pipe, then the gate valve was opened.

Walt observed, "I notice that the test valve is tight."

The operator replied, "You ain't seen nothing yet."

He then opened the quick operating valve with the level handle. A solid column of water shot out into the tank. With a quick snap action he slammed the valve shut. The result was a loud shock and a violent vibration of the pipe. The valve leaked but not nearly as bad as the ones returned.

The operator repeated the test and then the valve leaked very badly.

Schneider asked the operator how long he had experienced this awful shock when closing a valve on the test rig.

"Oh," he replied, "It never happens with other valves, just with this quick operating valve. I just started testing them a few weeks ago."

"That sounds to me like water hammer," said Schneider. "Do you suppose it's possible that it has created a pressure high enough to blow up the valve body?"

Instead of answering the question, Walt remarked: "If you have an air line here on which we can test another one of these valves, I believe you will have the answer."

"There is a 100 psig air line projecting up through that bench in the corner."

"That's fine," said Walt and proceeded to screw the second valve on the end of the air line. He then filled the outlet of the valve with water and turned on the pressure. There was not a single bubble to indicate leakage.

His next move was to open and close the valve rapidly, 10 times. Again he filled the outlet with water and again there was no sign of leakage.

"That does it," remarked Schneider. "I am surprised, however, that the shock caused by shutting off the flow quickly in a water line with only 75 psig could do that much damage."

Cast Iron Valve Would Break

"Mr. Schneider, if that valve had been made of cast iron it would, in all probability, have broken in two. Just stop and think what it means to shut off a column of water in a fraction of a second when that water is flowing at its maximum velocity to atmosphere. My guess is that the pressure inside of the valve at the moment of closing was at least 1000 psig. Don't forget that water is noncompressible."

"You can rest easy, Mr. Spring. No more quick operating valves will be tested here again until we have installed air chambers or some suitable shock absorbers. Sorry we have put you to all this trouble, but I'm delighted you found the answer to our problem."

"That's one of my jobs," said Walt, "to find the cause of trouble and correct it. It's a good rule never to use a quick operating valve on any kind of a liquid line unless adequate provision has been made to eliminate shock. I'll be on my way now. So long and good luck."

"Goodby, and the same to you." ✠

- **Weather Bureau records show fickle climate trends**
- **moderately cooler climate predicted before 1960**
- **a reverse trend in the 1970's to restore warm climate**

Warmer Climate and City Growth Spur Air Conditioning

. . . as seen in this new analysis of the U.S. weather picture. Effects of climate and city growth on heating were discussed by the author in the August HPAC.

BY J. MURRAY MITCHELL, JR.

Dynamic Climatology Section
U.S. Weather Bureau

No simple climatic factor has yet been wholly accepted as an efficient index of air conditioning requirements, to compare with the deg day index of heating requirements. Although climatic trends of dry bulb temperature in the summer season yield some information as to trends in comfort, they do not give explicit consideration to the humidity factor.

Effects of City Growth

As in the case of the winter season, climatic temperature trends during the summer in a typical city are partly composed of a gradual warming which comprises the city growth influence. In general, the large scale variations of summer climate in the U.S. have been somewhat less pronounced than those of winter climate, and the city growth influence has been the more dominant factor in the warmer seasons of the year.

While the city growth influence has been partly manifest as a moderately upward trend of temperature through the decades, it has also been manifest as a downward trend of humidity. In terms of most hot weather comfort indices, however, the lowered humidity has not wholly compensated for the increase in temperature. In other words, the "effective temperature"— insofar as air movement may be disregarded—has increased with the growth of the cities to which it applies. And because construction of large buildings has helped to restrict ventilation, effective temperatures have increased even more rapidly from the point of view of city dwellers who must live and work near street level.

Humidity Data Lacking

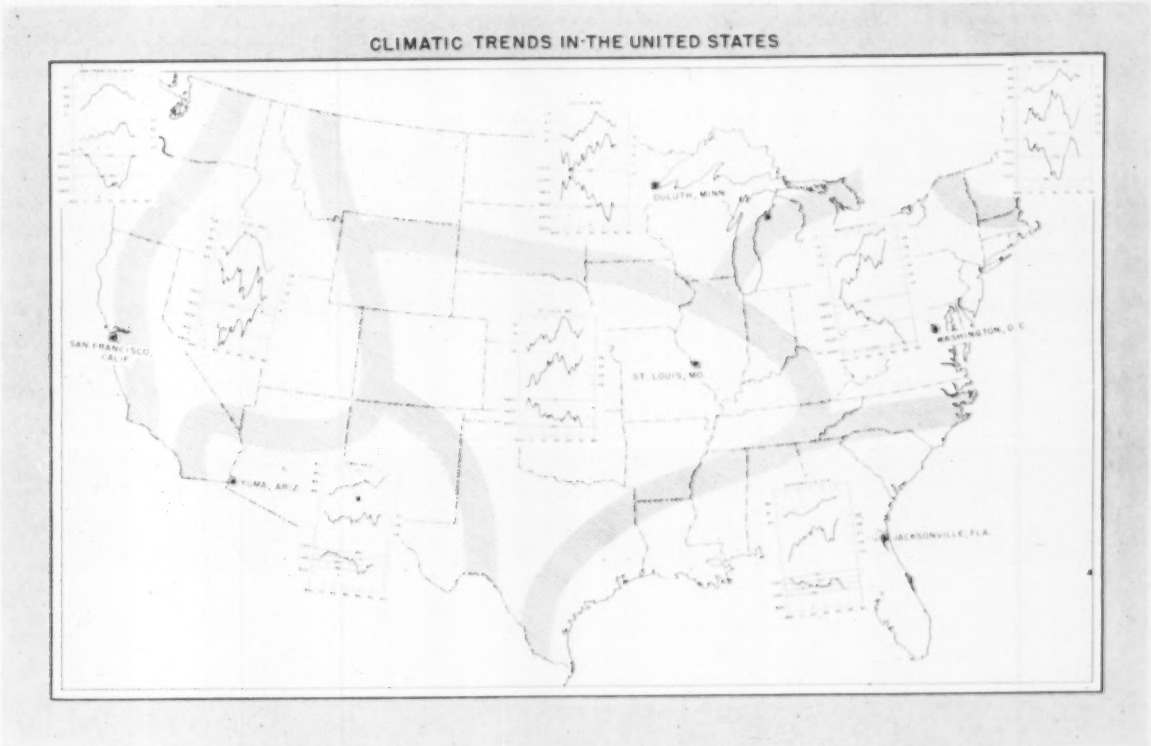
Humidity data which lends itself to long trend analysis is very hard to come by in the U.S. This means, for example, that comfort indices which are more realistic than summer DB temperature trends could not be included in Fig. 1. But, if the data were available, it is very likely that indices such as the number of hours of WB temperature greater than 66 F, which have been applied in air conditioning research, would have shown trends toward increasing discomfort.

The DB temperature data shown in Fig. 1 demonstrates that summers have been getting irregularly hotter in most U.S. cities. The local city growth influence has been augmented by a large scale change in summer climate which has brought somewhat hotter and drier weather to much of the country in recent decades. Exceptions to the warming of the climate-at-large in that season are to be found in parts of the West Coast and of the Rocky Mountain plateau, for which the San Francisco and Elko city records are believed to be fairly representative.

Let us return once again to the city record at Washington, D. C., to get a closer look at some characteristics of climatic change during the summer season which have been rather typical of many eastern cities.

In the upper part of Fig. 2 is shown the trend of summer mean DB temperature at Washington, averaged over the months of June, July, and August and expressed as a 10 year moving average. The thin sloping line depicts the estimated city growth influence. It is interesting that the level of temperature in recent years has not exceeded the levels of the late 1300's by a greater amount than what has been dictated solely by the city growth influence. The trend in observed temperature which followed the cold decade centered on 1905, however, has been much more rapid than that attributable to city growth. This, in turn, has reflected a large scale warming of summer climate in the eastern U.S. which gives some indication of having eased off after 1940.

In the lower part of Fig. 2 is presented the trend of summer mean WB temperature in Washington for a shorter period of available record.



1 CLIMATE TRENDS at specially selected cities in the U.S. are expressed here as 10 year moving averages centered on the dates indicated. The upper curve for each city represents the June-August mean station temperature. The middle curve represents the winter December-February mean temperature, and the lower curve, the seasonal heating deg day total. Horizontal lines through deg day curve, labeled 100, 105, etc., represent percentages of 1946-1955 decadal average deg day total. Boundary lines represent the very approximate geographical limits within which the major characteristics of the illustrated station trends are believed to be representative of other cities

This curve may be interpreted as a more realistic index of the trend in summer comfort than the curve of DB temperature. According to it, the late 1900's were just as "unbearable," on the average, as the years around—and probably since—1940, the intervening decades evidently having been more pleasant. Speaking in generalities, an upward—downward—trend in summer mean WB temperature can be translated with some confidence as an upward—downward—trend in the total seasonal number of hours of WB temperatures greater than 66 F. At Washington, however, which has experienced a larger city growth influence than most U.S. cities, the increase in number of hours with critically high WB temperatures has been roughly 10 percent since the 1920's, but has been almost negligible in terms of the more gradual trend found for the full period of record.

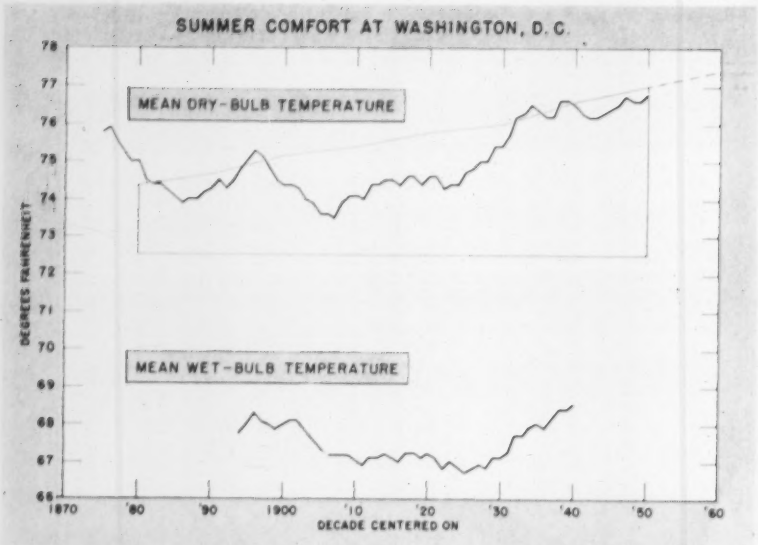
What Is the Outlook?

Having given so much attention to climatic trends of the past, it is only fair to go on to the question of the future. Is the irregular warming up of our climate to continue indefinitely, or can we expect a return to cooler conditions in future decades?

In answer to this question, let us deal first with the city growth influence and then with the far more perplexing problem of forecasting large-scale climatic changes.

Various estimates have been made of future population trends in U.S. cities. These invariably call for continued expansion of our urban centers at a rate which justifies simple extrapolation of the city growth influence at least to 1975. As an example of this, the projected city influence trend for Washington D. C., has been added as a dashed line in Fig. 2. To the important extent that temperature trends at city weather stations have been determined by the city growth influence, it will be relatively difficult in future decades for urban temperatures to return to the low levels of previous decades as the result of variations in the large scale climate. Similarly, it will be relatively easy for temperatures to creep toward new record highs unless the large scale climate takes a marked colder turn.

Now, with regard to future shifts in our climate-at-large, to venture a forecast of them is to tread on very thin ice. While trends in city growth influence can be extrapolated into



2 SUMMER CLIMATE TRENDS — June through August — in Washington, D. C. are shown here. The upper curve represents the mean dry bulb station temperature since the beginning of record. The thin sloping line superimposed on this curve shows the estimated rate at which the temperature in the summer season adjusted to expansion of the city. The lower curve represents the mean wet bulb station temperature in the period 1890-1945. Data from U.S. Weather Bureau city station

the future with some physical justification, there is no logical basis for extrapolating apparent trends in large scale climate itself. In other words, although our climate has certainly been changing, it has not been changing in a very regular manner which lends itself to prediction through statistical reasoning.

What Causes Climatic Changes?

The only solution must evidently lie in some basic understanding of the cause of the climatic changes we have measured, and, over this phase of the story, academic controversy has been with us for years. The more reasonable theories of climatic change have revolved around the supposed effects of volcanic eruptions, sunspot activity, an increasing concentration of carbon dioxide in the atmosphere, meandering ocean currents, and other natural phenomena. Less plausible theories have been based upon presumed reactions of our atmosphere to pervasion by atomic debris or cloud seeding chemicals, the importance of which has sometimes been publicly exaggerated.

It is unfortunate that the present state of our knowledge of the cause of climatic change is such that no one can be very sure of his ground in proclaiming the validity of one theory over that of another. Many theoretical climatologists believe in some combination of theories as being necessary to account for all the facts of observation.

Hence, reliable prediction of future changes in our general climate is, at the present time, no more possible through physical reasoning than it is through statistical extrapolation. Only one of the potentially valid theories of climatic change can reasonably be relied upon to perpetuate the general warming of our climate in the future. According to the other theories, a reversed trend toward cooler climate could conceivably commence at any time.

Here's "Best Guess" for Future

In view of this situation, it would be foolish of me to pass on a concrete prediction of climate for future decades. On the assumption, however, that some kind of "best guess" constitutes a lesser evil than complete silence, I shall risk closing with this strictly unofficial outlook:

Especially in those parts of the U. S., and in those seasons, which have experienced the most active large scale climatic warming in the past few decades, a tendency toward moderately cooler climate is likely to set in before 1960. The tendency should reverse again in the 1970's, and, by the early 1980's, the city growth influence will have helped to restore the climate of many of our cities temporarily to about the high temperature levels of today. As for the longer range picture, future research may give us the clues for more positive predictions than are presently possible. ∓

Install Thermostats on Electric Power Poles

. . . to regulate transformer capacity

To KEEP from "blowing its fuse" this summer as perspiring citizens turned on air conditioners and refrigeration units, one big Midwest utility installed thermostats on its power poles, according to the Minneapolis-Honeywell Regulator Co.

Purpose of this unusual application is not to heat — or cool — the outdoors, but to get advance tipoffs on temperature changes so the power company can better cope with the increased electrical demand by switching on more transformer capacity. Time clocks and other control devices proved unsatisfactory because they could not differentiate between hot and cold days.

The problem was solved by installing industrial thermostats on the power poles. As the temperature rises to 75 or 80 F, the thermostat automatically switches in more transformer capacity to meet the extra load demands. Conversely, as the temperature drops, it cuts out the extra capacity. ∓

The Law and Your Profits

BY WILLIAM HURD HILLYER

Inadequate Records Bring Trips to Court

INADEQUATE RECORDS bring trips to court which can cause loss of time and money. A proper bookkeeping system well maintained affords the best insurance.

Mr. and Mrs. N. Stallem were partners in the air conditioning contracting business at Easeville. They often joined the Deelah Air Conditioning Corp. in contracts for the sale and installation of equipment. These activities resulted in numerous debits and credits for account of first one and then the other of the joint participants during a 3 year period, culminating in a written agreement that purported to settle all matters.

Thirteen months after this agreement was signed, Deelah brought suit against the Stallems "to reopen, surcharge, and restate an alleged account stated." Errors in the Stallems' favor were supposed to have occurred either through mutual mistake of parties or by mistake of fact on the part of Deelah and fraud on the part of Stallem. In chancery, Stallem set forth "accord and satisfaction" or compromise of accounts between parties as a complete defense of the suit. From a $3091 decree in Deelah's favor the N. Stallem partnership appealed.

The chancellor, Stallem contended before the higher court, made a mistake in refusing to hold that a written settlement of accounts constituted an irrevocable accord and satisfaction instead of an account stated, as the chancery court found. Furthermore, Stallem argued, there was no evidence to support the chancellor's finding that errors of $3091 in the written statement had occurred as a mutual mistake of facts.

Evidence showed that Deelah and Stallem had been indebted to each other in varying amounts from 1951 to 1953. Stallem kept inadequate records and did not furnish Deelah with statements of charges for labor and materials. In closing out two contracts for accounting and income tax purposes on December 31, the Deelah Air Conditioning Co. estimated the amount due by it to the Stallems at $3000, and were credited with that sum on Deelah's books. Stallem's continued failure to keep proper records or furnish the Deelah Co. with statements due it precluded "a balancing of accounts from time to time," said the Supreme Court.

A year and a half later, Deelah's president demanded a statement. Thereafter he furnished the Stallems with an itemized statement of what they owed his corporation on September 25 of that year, and in a similar manner the Stallems submitted to Deelah a statement of the amount owed to them on October 3.

The written agreement settling the accounts between them was entered into October 12. Therein each party accepted the account previously rendered to each other as "stating the correct amounts due one another, and Stallem paid Deelah $521.21, representing the difference between the two accounts, "in full settlement." At that time — believe it or not — neither party recalled the $3000 estimated credit given Stallem December 31. This credit was overlooked and not taken into consideration in reaching the settlement, the higher court pointed out. The result of this mutual mistake was to credit the Stallems with $3000 more than they were entitled to receive.

Not until Deelah's books were gone over for the annual audit sometime in the early Spring was the error discovered. The auditors required Deelah to set the amount back on his books as a charge against the Stallems.

Although Mr. and Mrs. Stallem testified that they did not know about the $3000 error until three summers later, they admitted that they had noticed the discrepancy when Deelah rendered statements long before.

"It was also undisputed that each party accepted at face value the respective statements of account which formed the basis of the written settlement . . . and that neither party noticed or considered the $3091 at that time," the state supreme court declared. "Each party through mutual mistake thought it was receiving everything due . . . The letter agreement of October 1953 constituted an account stated," which has been defined as "an account balanced and rendered with an assent to the balance, expressed or implied".

The learned justices held that an account stated is only *prima facie* correct, and can be attacked on grounds of fraud or mistake. A court of equity, the higher tribunal maintained, will not permit an account stated to be conclusive upon the parties where there has been any mistake, fraud, omission, or undue advantage "by which it is in truth vitiated" and the balance is incorrectly stated.

The supreme court affirmed the chancellor's findings. +

WILLIAM HURD HILLYER, *author of this regular feature, is a contributor to a number of banking and financial publications and has written several books on business. He has an extensive practical legal and financial background.*

This series presents actual cases. Naturally, laws vary in different states. All names are fictitious.

HOW TO

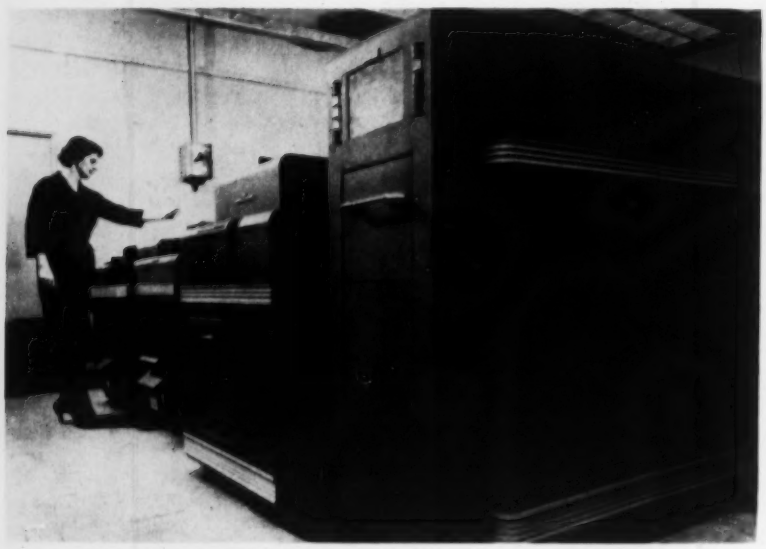
Solve Pipe Expansion Problems By Punched Card Machines

Here is a procedure for the solution of steam turbine pipe line flexibility problems by the use of punched card machines. The procedure can be used for pipe line systems made up of any number of straight and curved members. The time required for solution varies according to the number of members and branches, but in general, a single branched problem takes 1½ hr while a two branched problem takes 2 hr.

BY L. H. JOHNSON

Large Steam Turbine-Generator Dept., General Electric Co.

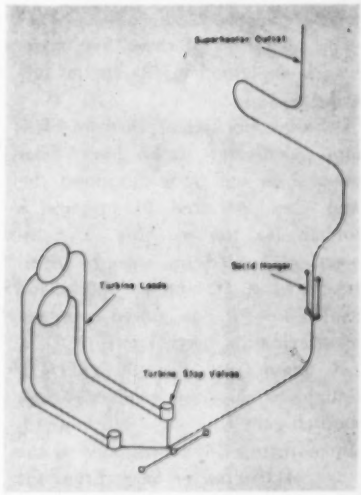
CALCULATION of the flexibility of most pipe line systems used in conjunction with steam turbines is a very time consuming job. Only in the most simple of pipe line analyses can the operations be performed in a few hours. Usually for systems with a fair degree of complexity, the calculation time is measured in terms of weeks, rather than hours. For any calculation that requires this amount of time, the chances for human error are always present, and much time is lost finding and correcting these errors. In addition, the sequence of the operations performed is sufficiently complicated so that only those with a great deal of experience can satisfactorily perform the calculations. This quite naturally tends to overload the people who do the actual calculations and results in delays in the preliminary design stages of the piping system. Ordinarily, a system is worked out that will produce less than the allowable stress by making simplifying assumptions, but time cannot be taken to work out a system that will do the job for the least amount of piping. In other words, time cannot be taken to design an *efficient* system because of the time required to perform the calculations.



1 PUNCHED CARD MACHINES read problem and instructions from five decks of cards, rapidly perform the calculations, and yield correct solutions. Their use is a routine calculation method during early design stages of steam turbine piping systems

Here is the procedure now used in our company for the rapid solution of these pipe line problems by personnel relatively inexperienced in pipe line analysis. The solution of problems is resolved into the proper sequence of cards being fed into a punched card calculating machine. The time required to solve a problem that has been presented in the form of an isometric sketch varies with the

number of restraints and members. In general, a single branch problem requires a total time of 1 ½ hrs, while a two-branched problem requires 2 hrs. The solution is good for any number of straight or curved sections of pipe that can be resolved into a working plane perpendicular to one of the coordinate axis. The straight sections may be inclined at any angle, and the curved sections may have any included angle of arc.



2 MAIN STEAM LINE WITH TWO RESTRAINTS is typical of larger systems that may be solved by card machine calculations. Problem is broken up into several sets of six equations that are inverted and combined to obtain a mathematically correct solution

Use General Analytical Method

There are a number of recognized and accepted methods of calculating piping stresses, as for instance the "general analytical" method, the "elastic center" method, the "Karelitz-Marchant" method, the "algebraic" method, and the "grapho-analytical" method, to mention a few. The method we use is the general analytical method since the calculation of the constant coefficients of the resulting simultaneous equations is readily adaptable to punched card machines.

In order to understand the card handling routine that is used, a brief review of the general analytical method is necessary. The pipe line is resolved into its individual straight or curved members, and each one of these members is assigned to one of three (x, y, z) coordinate planes. The line moment and products of inertia known as "shape coefficients" are then calculated for these individual members, and a summation of the shape coefficients is then made. These summed shape coefficients then become the constant coefficients that are used in the basic six simultaneous linear equations for a single branched system. The solution of these six equations yields the reactions at the coordinate origin caused by the restraint on the piping system. Once the reactions are known, it is an easy matter to calculate the stresses. The deflections at a given point "N" are determined by summing up the shape coefficients from the origin to the point "N" and by using these to obtain the constant coefficients for the basic 6 x 6 matrix. The deflections are then calculated by multiplying the proper known reaction by the proper constant coefficient to obtain the six deflections θ_x, θ_y, θ_z, δ_x, δ_y, and δ_z. (Symbols used in this article are the same as used in the general analytical method.)

For two branched systems, the solution results in 12 equations that are made up of groups of the basic 6 x 6 matrix. They vary one from another in only that the shape coefficients are summed over different branches of the system.

The shape coefficients that must be calculated for each member require, on the average, four separate arithmetical operations. Also, for inclined sections of straight pipe and for curved sections of pipe, tables must be referred to in order to obtain certain constants. It is therefore evident that a great deal of time is necessary to calculate these shape coefficients; this, together with the length of time necessary to get a correct solution to the resulting simultaneous equations, is the reason so much time is needed to make a flexibility calculation. Obviously, some type of computer would be a great help if these calculations were to be performed on a production basis.

Machines Do The Work

The calculating machine used is an International Business Machines Corp. card programmed calculator, Model 2, with three storage units. The name, card programmed calculator, indicates the basic principle of the IBM-CPC. According to the instructions punched on cards, the machine will multiply, divide, add, subtract, or extract square roots of numbers that are stored in the storage register or "memory" of the machine. For instance, in most arithmetical operations, two members, A and B, are operated on to obtain a third number C. It is therefore necessary to code one card telling the machine out of which storage registers to get A and B, what operation to perform on them — add, subtract, etc. — and where to send the result, C. To perform a given series of calculations, the initial data is punched on "spread load" cards that are then followed by the properly coded program cards. The spread card plus the coded program cards make up a program deck.

Card Handling Routine

The card handling routine can be divided into the handling of five main card program decks. These decks are:

I. Shape Coefficient Deck.
   a) One deck for straight members.
   b) One deck for curved members.
II. Equation Solution Deck.
III. Check Deck.
IV. Stress Deck.

V. Deflection Deck.

The operation of these five main decks is explained briefly in the following sections:

I. Shape Coefficient Deck — The shape coefficient decks have been prepared to cut to a minimum the setup time required to prepare a problem for the machine. The information needed for straight members is L, α, Q, and the plane the member lies in. For curved members the information needed is α, θ, Q, t, r, R, plane, and rotation (plus or minus). This setup arrangement eliminates the time consuming operation of listing the coordinates of the center of lengths or arcs. From the above data the machine will calculate the shape coefficients that are then punched on cards that become the "load" cards for the next deck.

II. Equation Solution Deck — As explained along with the general analytical method, the number of equations that are necessary to solve a piping problem depends on the number of restraints. A single branched system will have six equations, a two branched system, 12, a three branched system, 18, etc. In addition, any stops or solid hangers will add additional equations depending on their action.

Decks have been prepared that solve up to 14 equations. For larger systems similar to the one shown in Fig. 2, the problem is broken up into several sets of six equations that are inverted and combined to obtain a mathematically correct solution.

III. Check Deck — Upon solution of the simultaneous equation, the roots are substituted in the original equation to act as a check on the equation solution operation.

IV. Stress Deck — Stresses are calculated at all desired points by inserting in the stress deck the parameters that determine the stress at any point. These are the roots of the simultaneous equations, coordinates of the stress point, pipe size, and internal pressure.

V. Deflection Deck — As explained in the section on the general analytical method, the deflections of a point "N" are obtained by multiplying the coefficients of the basic 6×6 matrix by the proper known reaction. The coefficients for this matrix are obtained by combining in a manner similar to that outlined for the constant coefficient deck the summed shape coefficients between the origin and point "N". Since punching does not disturb the summed shape coefficients that are in storage, the summation may continue on to the next deflection point, and the like. These operations may be carried along simultaneously with the calculation of the shape coefficients that are used in determining the constant coefficients of the simultaneous equations. Once the deflection matrices have been calculated, they are set aside to await solution of the simultaneous equations. The roots of the simultaneous equations will be the internal reactions at the origin caused by restraints; and since they will be left in the storage registers, the deflections at various points can be calculated by the deflection deck.

Method Is Early Design Step

The above method of solving piping expansion problems on punched card machines has been set up as a routine calcuation method to be used during the early design stages of steam turbine piping systems. The draftsmen laying out the piping systems prepare an isometric sketch that is then presented to girl engineering assistants. They prepare the problem for the machine, run the problem, and submit the results back to the draftsmen. Instructions have been given to the draftsmen to live within certain allowable stresses and end reactions. Engineers enter the picture only if results should be questionable or if the problem involves special flexibility features.

In many large central station main steam piping systems, the design is limited by end reactions imposed on the turbine and the boiler. In most cases the large diameter, heavy walled station piping only gets hot and expands into the turbine and boiler. The stresses in this piping are usually well below the allowable stresses of the applicable codes. Machine calculations have been very helpful in several large modern turbine-generator installations by making it possible to study several methods of restraints to protect end points and stress up the large diameter pipe in the middle of the system. Re-runs are conveniently made since all of the setup work has been completed and several of the operations need not be repeated. This has, in several cases, resulted in a minimum of heavy forged and bored pipe that has met both the limitations of the required codes and of the equipment manufacturers. ≠

Hotel Installs High Velocity Air Conditioning

. . . to cost $1 million plus

THE FIRST complete high velocity electronic air conditioning system in a hotel is being installed in the Barbizon-Plaza in New York City, according to the Trane Co.

Costing over a million dollars, the revolutionary new cooling-heating system is the result of electronic research and development work by several manufacturers.

Outside air will be drawn in at the top of the 40 story building. Here it will be filtered, dehumidified, chilled to 46 F and pumped rapidly down two main insulated 36 in. ducts. From here the air will be slowed down by diffusers and fed noiselessly to 1100 guest rooms through 2½ miles of small ducts.

Heart of the chilling operation consists of two 300 ton centrifugal compressors, which will be installed on the building's top floor. They are automatic and hermetically sealed.

Chilling will be effected by constant recirculation of water mixed with antifreeze and kept to a 35 F temperature.

Relative humidity of the air will be kept at 40 percent, as against 50 to 55 percent in earlier hotel air conditioning systems.

Jaros, Baum & Bolles are the consulting engineers in collaboration with Abbott, Lester & Co., Inc., who are doing the installation work. ≠

Sam Lewis' Page

Correct Faults of High Pressure Air Conditioning in Office Building

. . . inadequate perimeter radiation, misapplication of thermostats, and excessive air pressure

I WAS ASKED to diagnose the failures to provide comfort in a Greek temple type of office building. The building is the home office of an insurance company.

This decidedly up-to-date architectural opus, three stories high, is alleged to be completely air conditioned by a high pressure air distribution system. Heat is supplied by oil burning boilers.

The architect's engineer had a conviction that the heat loss through the exterior glass and walls must be supplied by hot water radiation below the windows.

Left Gaps in Perimeter

He did not, however provide this continuous finned tube perimeter radiation under all of the windows, but left gaps along the windows in larger rooms, and particularly at the corners the gaps increased.

He supplied the warm air for winter through overhead bay center ceiling diffusers, below noise absorbing air mixing boxes concealed above the suspended acoustic ceiling. The same boxes and diffusers deliver cool dry air in summer.

Thermostats Misapplied

He did provide an occasional thermostat to adjust poppet type valves in the air mixing boxes, so as to deliver a mixture of warm air or of cool air as required.

Obsessed by his perimeter type yen, he ignored the possible services of the room thermostats that controlled the dampers in the air inlet boxes, but served all of the perimeter radiation on the north side of the building by separate flow and return main pipes.

The north radiators responded to a north side pump, controlled by a north side thermostat hidden under a lock and key outdoors on the north side of the building.

He repeated this scheme on the other three sides, each with three outdoor thermostats.

The perimeter radiation on each side thus gave off heat whenever the outdoor thermostat on that side of the building became cold. This heat warmed the thermostat in the room that had the indoor air supply. As a consequence, the warm room thermostat called for cool air.

Confidence in thermostats, in the minds of the occupants of these rooms soon was lost, as they suffered.

An outdoor thermostat to control an automatic fuel burner in a small building may be acceptable, because no fair average location for the room thermostat can be found in the building. The application of the outdoor thermostat for controlling the indoor temperature in large buildings requires consideration of many additional factors.

For this insurance company the outdoor thermostats have become a surplus item. The indoor thermostat in each room controls the controllable sources of heat, both by radiators and by air delivery.

Exhaust Fans Omitted

On the same inspection visit I discovered that the outside doors that properly swing out are difficult to close. The door from any large division of each story to any room that has an open window is difficult to open.

I found that there was no provision for relieving this excessive pressure within the building. There was no exhaust fan, except for toilet rooms. The expectation of forcing 40,000 cfm of air out through window cracks could only have failed.

To correct the situation, a safety valve exhaust was recommended and installed. ‡

SAMUEL R. LEWIS, *consulting mechanical engineer and a member of HPAC's board of consulting and contributing editors, comments informally each month on practical heating, piping and air conditioning problems.*

Boiler Plant Is White Elephant

Overdesign of this heating system resulted in inadequate heat control and tripled fuel cost. Excessive boiler capacity, with the unnecessarily large boiler room, excavation, controls, pumps, accessories, and oversized smokestacks, cost at least $175,000 more than would the efficient plant which should have been designed. Corrective alterations costing $32,000 boosted the total money wasted to more than $200,000.

BY CHARLES F. NEERGAARD

Hospital Consultant, Retired

and

CHARLES E. DANIEL

Consulting Engineer

TRUSTEES of a new mid-western hospital discovered that they had a white elephant in their basement where the boiler plant should have been and sent us an urgent call for help. During 13 months of operation, the superintendent had reported many serious troubles with the heating plant and other mechanical equipment.

Our investigation included:

1) The boiler plant when operating with winter and summer loads.

2) The fluctuating water pressure in the hospital.

3) The reduction of high temperatures in rooms above and adjacent to the boiler room. Also noted were various structural and engineering features which complicated the problem.

The 250 bed hospital and 160 unit nurses home on an open site were planned for 100 percent expansion in the future. The main building, which has four stories and a basement, was designed in the modern architectural vogue, with oversized windows. Heat loss through the windows was so bad that 50 percent more steam was needed for heat when the wind blew. The exterior walls are 4 in. face brick and 8 in. concrete block backing with plaster directly applied. This type of wall is not only extravagant in heat loss but hazardous in terms of leaks and dampness.

The boiler room is in the subbasement, with two 500 hp oil fired boilers and space for a third. The boiler room had one small area opening, but no windows nor exhaust ventilation so that offices and storerooms above and adjoining were so overheated as to be practically useless. These rooms had radiators too!

The engineers, looking 10 or 15 years ahead, had anticipated future expansion and installed at the start 1000 boiler hp, ample to heat the ultimate 500 bed hospital and nurses home and a lot of "all outdoors."

Each of the 500 hp boilers had a capacity of 16,000 lb of steam per hr. The maximum peak steam load required for services and heating in zero weather was 10,000 lb per hr or approximately the capacity of a 300 hp boiler. The steam requirements checked by meter in the late afternoon when the outside temperature was 5 F showed a boiler load of 230 hp. At 9 o'clock the next morning, when the laundry, sterilizers, kitchen, and hot water loads were on, the meter showed a total boiler load of 280 hp.

Consider what this means. In zero weather only 60 percent of the capacity of one boiler was required. For at least half of the year — late spring, summer, and early fall — the day time load was only 12 percent of the rating of one boiler. The load at night and on Sundays and holidays was 400 lb of steam which could be supplied by a 12 hp boiler.

Mr. Neergaard, a hospital consultant for 35 years, has served as advisor on over 350 hospitals. An investment builder for 10 years, he directed the planning and construction of over 200 buildings. He has been a trustee of five hospitals, with an aggregate service of 76 years. As a patient he has put in 29 weeks in six hospitals.

To encourage development of generally improved standards of hospital design, Mr. Neergaard has for eight years sponsored a fellowship in hospital architecture at the Yale School of Architecture. Currently he is helping to set up a study program on various phases of hospital design and operation, including engineering.

He has for over 20 years waged a campaign to cut out waste in the hospital mechanical plant.

Mr. Neergaard has had several previous articles published in HPAC.

Mr. Daniel's previous experience has included the design of many hospital plants and service as consultant to the Division of Hospital Facilities, U. S. Public Health Service.

For Hospital

Yet the hospital had no alternative than to operate that 500 hp boiler at absurdly and extravagantly low efficiency. The hospital was consuming three times as much fuel as it should have burned and was building up excessive deterioration of firebrick from the destructive off-and-on firing.

Load Was Below Control Limits

Automatic controls of the most approved and expensive type had been installed to control the boiler steam pressure from 100 percent to 20 percent of the 500 hp boiler rating. These controls would have functioned satisfactorily had the maximum load been 500 hp and the minimum 100 hp. But with a maximum of 300 hp and a minimum of 12 hp, with the boilers operating most of the time at a steam load far below the limits of the controls, it was necessary to have an engineer 24 hr a day watching the steam gage and starting and stopping the oil burner by hand. This meant five fulltime firemen.

Install 150 Hp Package Boiler

To correct the conditions resulting from the boiler overdesign, it was recommended that a 150 hp package type water tube oil fired boiler be installed, with automatic modulating controls from 100 percent to 20 percent of capacity and off-and-on controls below 20 percent capacity.

This boiler will take care of the spring, summer, and fall loads so that the large boilers can be shut down for six months of the year. Cost of the new boiler and equipment was estimated at $22,000.

To provide for emergencies and to take care of sterilization at night during summer, installation of a high speed pressure electric sterilizer in the operating suite was recommended.

Ventilate Boiler Room

The underground boiler room with no forced ventilation and only a small areaway was insufferably hot. To correct this, installation of a 4500 cfm high speed supply pressure fan with a two speed control motor was recommended, as well as a duct to blow outside air to the back of and across the boilers, with one outlet over the new 150 hp boiler and another outlet over the deaerator.

Part of the air supplied to the boiler will be used by the oil burner for combustion and the excess will be exhausted through the oversized chimney and existing areaway. This will remedy the overheating of adjoining space in winter and materially improve it in summer. Installation of this equipment was estimated at $5000.

Radiators Too Big, Too Many

Cubage of the hospital and nurses home totals 2.1 million cu ft. Total radiation in the two buildings was 33,000 sq ft. Throughout the buildings, radiators were far larger than required, but this was theoretically compensated for in terms of comfort by the installation of a thermostat in each room costing upward of $100 per unit.

If circulating hot water heat had been used, this expense for individual thermostats would have been unnecessary. Radiation in the stair wells was also excessive, and radiation in the rooms over and around the boiler plant superfluous.

Stabilize Hot Water Pressure

With 60 psig water pressure in the street main, the laundry pressure frequently dropped as low as 8 psig, while the pressure throughout the hospital varied from 30 to 60 psig. This was caused by a water softener far too small to supply both laundry and hospital requirements. The drop in pressure to the laundry was caused by the passage of the laundry water through the small tubes of an instantaneous heater.

The laundry water was heated to 180 F by an instantaneous heater, which meant that all the water to fill a washer had to be heated in about half a minute, making excessively heavy demands on the boiler for this period. The hospital water was heated to 150 F in two 1900 gal storage tanks. This capacity was sufficient for both laundry and hospital.

To correct this, hot water connections were changed to supply both laundry and hospital from the two tanks. All water is heated to 180 F and goes direct to the laundry, and the water to the hospital passes through an automatic mixing valve to reduce the temperature to 145 F.

To meet the short heavy demands for water to fill the laundry washer, it was recommended that a closed surge tank be installed on the outlet side of the water softener. The closed tank is to have one-third of its volume filled with air when under street pressure. As the pressure is reduced, the air forces the water in the tank to supply the laundry and reduce the flow from the softener. The capacity of the tank should be three times the maximum water required by the large washer for one filling. This tank has been installed and has effectively corrected the difficulties.

The two existing 1900 gal hot water storage heaters were connected to supply 180 F water to the dish washer and laundry and 145 F water to the hospital through a mixing valve. The large storage capacity will permit the hospital in the nonheating

season to shut down all boilers at night to save fuel, and the salary of the night fireman as well. With this balancing tank, the softener functions normally, laundry operation will not be delayed for lack of water, and there will be no interference with the normal flow of 145 F water throughout the hospital. These changes to correct the water pressure and hot water supply cost the hospital approximately $1000.

Wasted Over $200,000

The total cost of the hospital building and nurses home was approximately 6 percent. The excessive boiler capacity with the unnecessary large boiler room, excavation, controls, pumps, accessories and oversized smokestacks cost the hospital at least $175,000 more than the cost of the efficient plant which they should have had. To this must be added some $32,000 required for the corrective alterations, bringing the total of money wasted to about $207,000.

The authoritative publications of the Division of Hospital Facilities of the U. S. Public Health Service demonstrate the value of insulated walls and windows and circulating hot water heat. They give figures on the amount of radiation needed in an insulated building and the most economical type of boiler installations.

If this hospital had been designed in accordance with the advanced principles and formulas which have proved successful in many hospitals:

1) The walls would have been insulated so as to provide a heat loss coefficient of 0.09 Btu per hr per sq ft of wall area.

2) The windows would have been of normal size and spacing, tight around the frame, and glazed with double glass.

3) The improved thermal capacity would have made it possible for some 13,000 sq ft of radiation — instead of 33,000 — to heat the approximately 2.1 million cu ft of building requiring heat.

4) The boiler installation, instead of 1000 hp, would have consisted of a 100 hp low pressure heating boiler and two 100 hp 125 psig high pressure boilers, or 300 hp, all cross-connected. This would have saved around $175,000 in boiler room installation alone. With insulated walls and double glazed tight windows, the reduction in radiation with hot water heat would have saved further $50,000, or a total of $225,000.

5) Also, the annual saving on fuel and labor would have been considerable.

The hospital reports that in 1955 its fuel cost was $27,077, with oil at 7.3 to 8.75c per gal. By comparison, a hospital on cold Prince Edward Island — a 210 bed hospital, thoroughly insulated, with two 60 hp boilers — in 1955 spent $13,059 for fuel at 10.36c per gal. At 8c, its fuel cost would have been $9366, a little over one-third of our "victim's" fuel expense.

Also in 1955, a Toronto 725 bed hospital — over three times as large in facilities with less than half of its buildings insulated — spent $51,516 for coal at $10 a ton and burned 150,000 gal of oil at 10.65c per gal. At a rate equivalent to 8c per gal, the total fuel bill would have been $12,500 vs the $27,000 spent.

Competent and economical engineering would prevent "burning up hospital money." ✣

Two 30 ton Units in Shaft Condition Store

SUPPLY DUCT serves each floor from 30-ton unit in old elevator shaft. Branch from first floor duct supplies basement

Two large packaged air conditioners providing comfort cooling in the Levitz Furniture Co. store in Pottstown, Pa., are installed in an elevator shaft that was not being used, according to the Airtemp Div., of Chrysler Corp.

One unit is on the first floor, and a twin is on the floor above. Each unit connects with a ceiling attached duct which spans the length of the store. A takeoff from the main floor duct supplies the basement level with air conditioning. Thus, the two units cool three floors.

Leon Levitz, one of the owners, says, "Our traffic has increased. We are able to hold customers longer, resulting in higher unit sales. Our store is much cleaner, reducing losses, and our employees are more efficient."

The installation was made by Pottstown Refrigeration & Ventilating Co. ✣

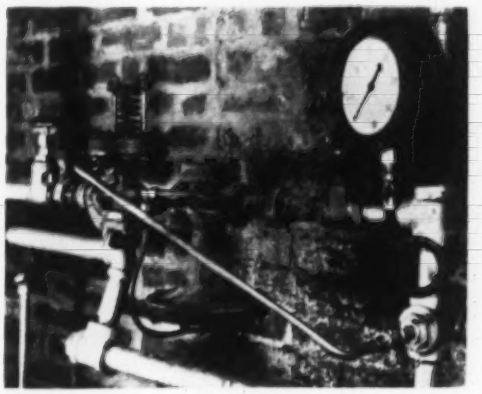
On the Job
—notes from the field

HOW TO

Change Pilot Valves in Minutes

. . . on main regulating valves

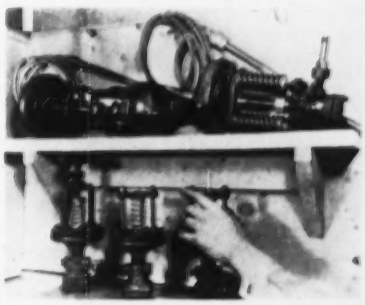
Here's one correct technique for easily removing one pilot valve and replacing it with a new or cleaned one, as recommended by engineers of the Spence Engineering Co., Inc.

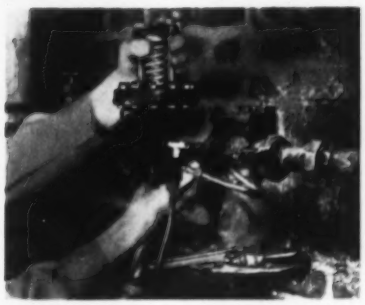


1 AUTOMATIC CONTROL of the flow of gases such as steam and liquids is efficiently accomplished by regulating valves. The main valve is placed in the main line as shown here. This valve is normally closed. The seat is opened to permit regulated flow by the action of the pilot valve which, in the arrangement shown, is governed by pressure. In spite of strainers, dirt traps, and other preventive measures, pilot valves need cleaning and inspection. This regulator station was well designed for maintenance. Both the main and pilot valves are accessible, and the pipe fitter is not hampered by interfering pipes. Gate valves isolate the pilot and main valves from the flow. The pilot valve is not enclosed in the housing of the main valve but is external and accessible. The main valve remains untouched. The first step, then, is to close the gate valves isolating the pilot.

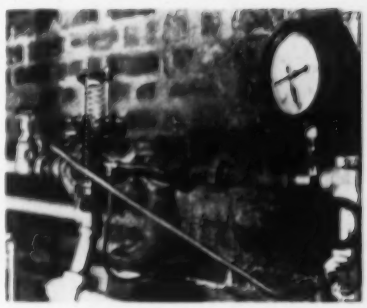
2 DISCONNECT the control piping from the pilot.

3 OBTAIN a replacement valve, either new or previously cleaned, from the store room shelf. Usually, an identical pilot will be replaced. However, should it be necessary, because of changes in the system, to change operating pressure of the main valve, a different valve can be selected and installed in place of the old pilot. Pilots are interchangeable on the main valve. Or, if it is necessary to regulate flow according to temperature, a temperature pilot with thermostat, as shown on the top shelf, can be installed. Temperature pilots are interchangeable on the main valve also. Usually, without changes in control piping, flow through the main valve can be controlled as to both pressure and temperature without disturbing the main valve.





4 INSTALL the replacement pilot and connect the control piping.



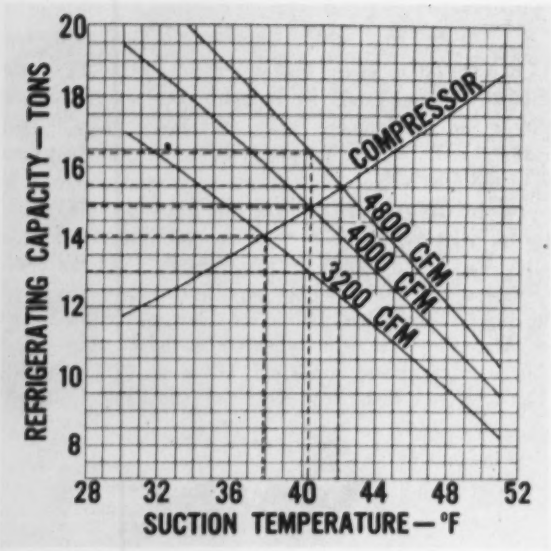
5 THE SYSTEM is ready for operation in a matter of minutes.

What Factors Affect Evaporator

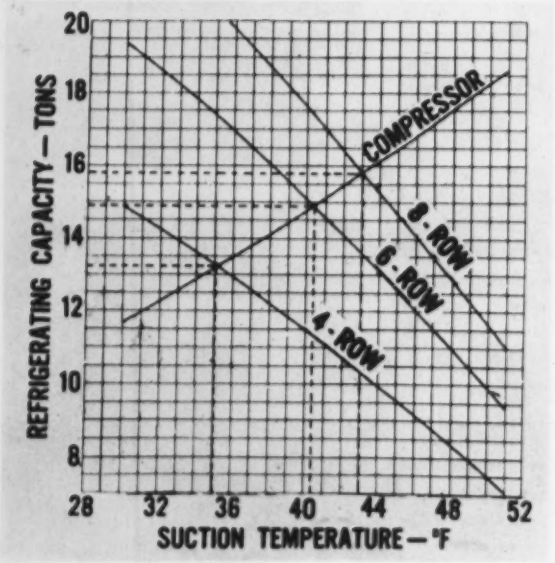
Here's the concluding part of an engineering analysis of the factors affecting evaporator performance, with respect to air flow, surface area, pressure drop and other variables in refrigeration system design.
The first part appeared in the October HPAC.

BY W. C. DACKIS

Manager
Process Heat Transfer
The Trane Co.



9 AIR FLOW CHANGES are directly proportional in effect on both suction and refrigerating capacities. Curve shows coil performance for a 24 by 48 in. six-row coil



10 EVAPORATOR SURFACE is also directly proportional in effect on suction and refrigerating capacities. Six-row coil balances at 35 F and 14.9 tons

IT HAS BEEN SHOWN that the capacity of the evaporator varies with air velocity. For a given unit, the larger the quantity of air handled, the higher the velocity will be and the greater the capacity of the evaporator. Here's the effect these changes in air flow have on the system.

Fig. 9 is a coil performance curve for a 24 by 48 in. six-row direct expansion coil handling 4000 cfm. For an example, it is assumed that this unit with face and bypass damper control. As the cooling load increases coil is installed in an air handling more air will pass through the coil. If this same coil, therefore, were to handle 4800 cfm, its performance would be shown by the curve above the performance curve for 4000 cfm. From the point of intersection with the compressor curve, the system using 4000 cfm would operate at 40.3 F suction with a capacity of 14.4 tons. At 40.3 F suction, the same coil with 4800 cfm has a refrigerating capacity of 16.4 tons. Connected to the compressor however, the system will operate at 42 F suction with a capacity of 15.5 tons.

Here is what happens. The increased air flow results in an increase in air velocity and a subsequent increase in capacity of the evaporator, which means there is an increase in the evaporation rate. Since the compressor is running at constant speed,

Performance Characteristics?

the additional gas created raises its suction pressure. But as soon as the suction pressure increases, the evaporator capacity decreases. Eventually, the balance point at the intersection of the two curves is reached. Notice that the increase in the capacity of the system is less than the increase of the evaporator capacity, because of the limitation of the compressor.

Similarly, if the cooling load demands a lesser air quantity through the coil, the system operates at a lower suction temperature but the decrease in system capacity is less than the decrease in the capacity of the evaporator if it were not connected to the compressor.

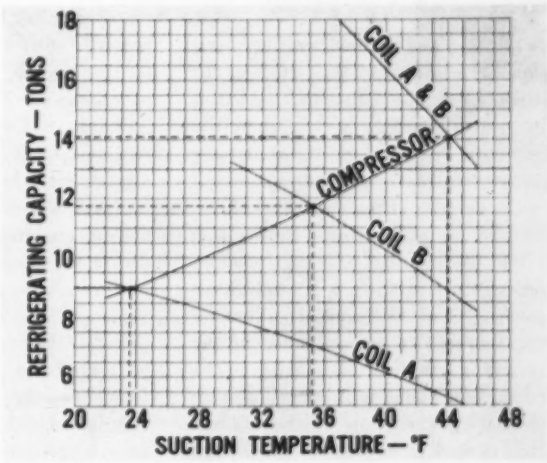
This can also be shown on the diagram by plotting another coil performance curve below the one for 4000 cfm (Fig. 9). If the coil were to continue operating at 40.3 F suction, its capacity with the reduced air flow would drop to 13 tons. But connected to the compressor, which now has less gas to compress, the suction pressure is reduced so that the system has a capacity of 14.1 tons.

For a given system, therefore, with constant condensing temperature and constant compressor speed, both suction and refrigerating capacity vary directly with changes in air flow. Thus, if a system has higher static than calculated, lower capacity can be expected. To sum up, with increased air flow comes higher suction and greater capacity; while reduced air flow results in lower suction and less capacity.

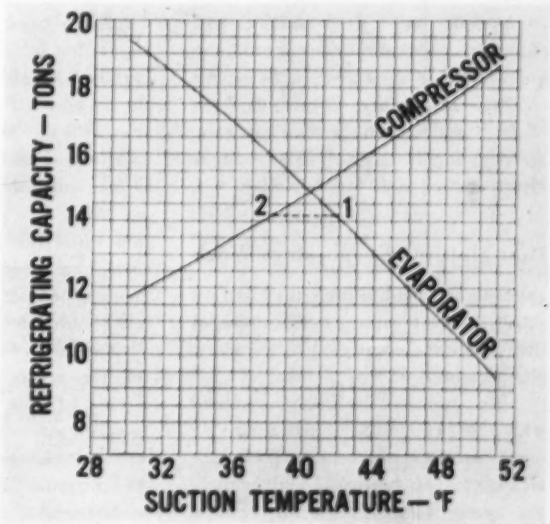
Capacity Varies with Surface

What happens when the amount of evaporator surface is changed will be analyzed with the aid of performance charts. In an actual system this situation can occur when row control is used, that is, when the number of rows is changed for varying load conditions. The amount of heat that can be dissipated is proportional to the amount of surface in any type of heat exchanger, including the evaporator. The more rows that are added or the closer the fins are spaced, the greater will be the coil capacity.

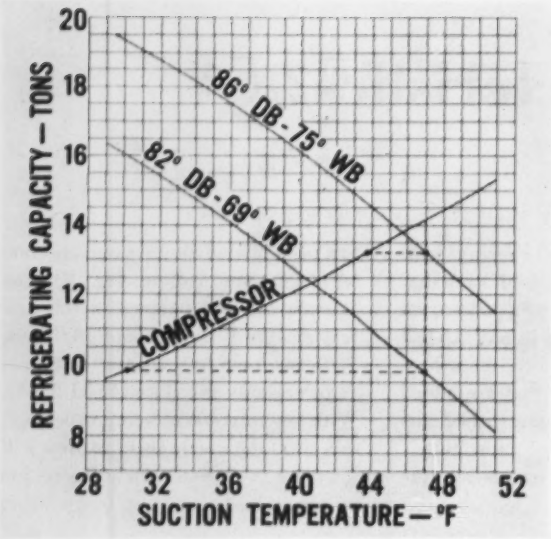
To show the effect graphically the performance curve of a four-row coil has been plotted on the same diagram with a six-row coil in Fig. 10. The six-row coil will balance in this system at 40.3 F suction and 14.9 tons. With two rows less surface the evaporator capacity is reduced to 11.3 tons. With less refrigerant being vaporized, however, the compressor suction will decrease so that ultimately the system will balance at a suction temperature



11 MULTIPLE EVAPORATOR CAPACITY, at any one suction temperature, is the sum of individual capacities. At 44 F, combined capacity of Coils A and B is 14.1 tons



12 PRESSURE DROP in the suction line decreases the refrigerating capacity of the system. The greater the drop, the greater the loss in capacity



13 BACK PRESSURE CONTROL VALVE to maintain a pressure in evaporator corresponding to a particular suction temperature, reduces required refrigerating capacity

of 35 F. The system refrigerating capacity will be 13.2 tons. Here again it should be noted that the reduction in system capacity is less than the reduction in coil capacity if it were not connected to the compressor.

Conversely, if the coil depth is increased to eight rows, the system would balance at a higher suction temperature of 43 F, and would have a capacity of 15.8 tons. In this case the increase in the capacity of the system is less than the increase in the evaporator capacity if operation were at the same suction as the six-row coil. It may be stated, therefore, that for a given system with constant condensing temperature and constant compressor speed, both suction and capacity are proportional to the amount of evaporator surface. An increase in surface will result in a higher suction and greater capacity. A reduction in surface will result in lower suction and less capacity.

How Multiple Evaporators Work

Some air conditioning installations require two or more evaporators of different sizes connected to the same compressor.

This practice is fairly common when the evaporators are relatively close to the compressor. It is not recommended, however, for remotely connected evaporators for several reasons: more refrigerant is required to charge the system; the chances of leakage are multiplied; proper distribution of liquid is more difficult; and control of the system is more of a problem. The system performance for multiple evaporator installations can be analyzed very readily by the use of the diagrams in Fig. 11.

Curve A on Fig. 11 represents the capacity of one evaporator and Curve B the capacity of a second one connected to a compressor whose performance curve is also shown. It stands to reason that at any one suction temperature the combined capacity of both evaporators will be the sum of their individual capacities. Thus, the capacity of both coils can be plotted by adding the two curves together, as shown by Curve C and the system will operate at 44 F suction with a capacity of 14.1 tons. The capacity of each coil at 44 F suction is 5.3 and 8.8 tons respectively.

If Coil A is removed from the system while Coil B remains connected to the compressor, the capacity and suction temperature of the system will immediately fall to 11.7 tons and 35.3 F respectively. If Coil B is shut off, the system will then have a capacity of 9.0 tons with a suction temperature of 23.5 F. This would result in frosting of the evaporator and eventual malfunctioning of the system and thus should be avoided.

Pressure Drop Lowers Capacity

So far, we have assumed a perfect system with no loss in the pressure of the vapor flowing from the evaporator to the compressor. In actual installations, the pressure drop in the pipe connecting the two will result in a higher pressure at the evaporator. Nevertheless, the weight of vapor pumped by the compressor must still equal that vaporized in the evaporator; in other words, their tonnage capacities must still be equal. In Fig. 12, therefore, the suction and capacity of the evaporator are shown as Point 1. Capacity and temperature corresponding to the lower pressure of the vapor at the compressor is shown as Point 2. The horizontal line connecting Points 1 and 2 represents the pressure drop in the suction line. It amounts to the difference in pressure corresponding to the evaporator and compressor suction temperatures.

If there were no pressure drop in the suction line, capacity of the system would be at the point where the two curves cross. The effect of pressure drop in the suction line, therefore, is to decrease the refrigerating capacity of the system as a whole. The greater the drop, the greater the loss in capacity because of the lower suction at which the compressor must operate. Generally, if the suction piping has been properly sized the pressure drop will be small enough to be neglected in analyzing the operation of a given evaporator and compressor. It is necessary to understand the effect of pressure drop, however, in order to analyze the operation of the back pressure control valve which is a special type of throttling valve sometimes installed in the suction pipeline between the evaporator and the compressor. This valve maintains the pressure in the evaporator at a constant point regardless of load to prevent frosting on the coil.

Use Back Pressure Control Valve

The action of the back pressure control valve is shown in Fig. 13. The two curves represent the capacity of one evaporator at different air entering temperatures. Capacity and

suction temperature of the system would be at the point where each curve crosses the compressor capacity curve if there were no restriction in the suction line. If the back pressure valve in the system were adjusted to maintain a pressure in the evaporator corresponding to the suction temperature shown by the vertical line — 47 F — the system would then operate at different conditions as determined by the intersection of the horizontal lines on the compressor curve.

For example, when the evaporator has the capacity as shown on the top curve, the capacity with the back pressure valve installed would be 13.2 tons. The pressure drop of the vapor from the evaporator to the compressor would be represented by the horizontal line between the coil and compressor capacity curves. Similarly, if the air temperature were to fall and the capacity of the coil were to decrease as shown in the lower curve, the capacity of the system would also be reduced. The drop in pressure through the back pressure control valve would be considerably larger as shown by the longer horizontal line. In both cases the suction temperature in the evaporator is the same, but different at the compressor. ◆

BORN 15 YEARS TOO SOON!

Sees Fabulous Future for Piping

Here's a preview of the piping progress that will be achieved in the next 15 years, as seen by an "old timer" who has stopped long enough to look into the crystal ball. What he sees will challenge younger engineers and contractors to expect startling piping developments in several fast moving fields.

BY G. W. HAUCK

Manager, Engineering Sales
Crane Co.

IN MY FIRST 15 years — 1913 to 1928 — not too much happened in the valve and fitting business. Looking back from 1956, I can only conclude that life was relatively simple way back then. We had brass and iron valves and fittings plus a few limited lines of low pressure steel materials. Essentially, we had screwed ends and flanged ends. Period. That was it!

Since then, we have covered an amazing period of 30 fruitful years. That's a big story in itself. But, here, let me just mention a few highlights.

- The development of many new steels and alloys for high pressure, high temperature services, corrosive services, low temperature work, etc.
- The advent of welding fittings and flanges and welding end valves, plus the development of welding as a method for making joints.
- Pressure seal bonnet design that revolutionized valve construction for high pressure and high temperature.
- Alloy bolting materials.
- Copper solder joint for other piping applications.

These items no more than skim the surface of the rich record of the past.

The author has been associated with Crane Co. 43 years and is very active in the piping industry. He is also a member of HPAC's board of consulting and contributing editors.

Tomorrow Will Be Fantastic

Today, we're on the threshold of another fabulous period. The next 15 or 20 years hold fantastic promise for the piping industry. I can predict that younger men in this field will find a lot of spicy challenge added to their activities. It is my conviction that we ain't seen nothin' yet! Look over my shoulder into my crystal ball a moment. View with me the kaleidoscopic picture as we contemplate just a few fields directly dependent on future piping progress.

- We've been hearing a little about supercritical steam stations. In fact, several electric utilities are pioneering now with such units under construction. But you'll see a lot more in the coming years. Some realistic planners forecast that 10,000 psig at 1100 F will be the order of the day in 1975.
- Just mention hydrocarbons and petrochemicals and you fire the imagination. These two industries and all their allied activities are go-

ing places. If no one else does, they alone will keep the piping people on their toes. As a result, you'll see alloys that haven't even got a name now.

• In corrosive services, plastics are being used right now where metal won't hold or last at all. Tremendous strides will be made in the continuing development of variations of plastics. Many new ones will appear and new names will be added to the roster. The future appears to be boundless in this field.

• You'll hear a lot more about automation and instrumentation and about their applications to piping. Time was — way back — when automation was a chain wheel on an overhead valve. Instrumentation was gages, thermometers, and some recorders.

Automation and instrumentation will provide plenty of impact on piping systems and valves. Piping — transportation of many different fluids, gases, and solids in many directions — needs controls for directing and regulating flow. Automation will do all sorts of things in tomorrow's piping. Instrumentation will tell what's happening and why.

• Atomic energy, particularly in its peaceful uses, holds boundless promise: for propulsion; for power; in agriculture; for medicine; for quality control and instrumentation; for research; for processing — you take it from there. The technical terms stemming from atomic energy that sound so mysterious and awe inspiring now will become commonplace words in everyday language.

• We read today about the guided missile program and have a sketchy idea of what it means. Offhand, some people might wonder what connection exists between guided missiles and piping materials? Plenty! Security precludes saying very much on this subject now. However, valves and piping are vitally involved. Somewhat akin to the atomic energy field, the impact on piping materials in the missiles field will be appreciable because the service conditions are extremely demanding.

These are but some of the fields opening up a whole new batch of challenges. To meet them, a whole new breed of valves and other piping materials is emerging. In one way, the materials and designs are revolutionary, but mostly they represent a continuing evolution that is the end product of much current background. Catalogs of the future will show designs that would indeed look strange in yesterday's catalogs and they're not even in today's catalogs either.

Progress Will Be Astounding

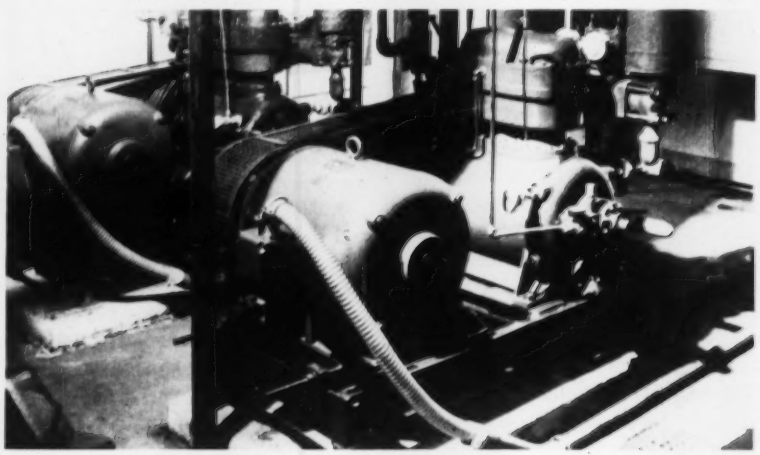
We've looked into the crystal ball long enough for this time. If you can't see a fabulous period ahead, you need new glasses or a shot of something. Inevitably, you who will be around in the coming 15 years will see a marvelous picture unfold in the world of valves and other piping materials. As for me? Well, I was born 15 years too soon but, believe me, I forecast this exciting future for the industry with confidence that progress will not only be rapid but astounding. ⊣

Central System, Package Units Condition Hotel Hershey

When the Hotel Hershey, Hershey, Pa., was partially air conditioned in 1954-55, two three-cylinder compressors were installed, according to the Frick Co. At that time the main dining room and 33 guest rooms were air conditioned.

This year an additional 69 rooms were conditioned. Two new compressors carry this load. The machines are mounted on vibration dampeners, and have oil safety switches in addition to pressure cut-outs and capacity controls.

The evaporative condenser, of 16,505 Btu per hr capacity, is also mounted on insulating pads. Rubber hose connections are inserted in the water lines at the pump, which is carefully insulated. A three pipe system of water mains, similar to that used on ice skating rinks, is used to equalize the pressures. The supply and return lines are 6 in. in diameter and are of course insulated. Risers



are of 1½ in. size. The water is chilled from 58 to 52 F in a shell-and-tube cooler handling 200 gpm.

Air units are installed in the bathrooms, or over the doorways of the parlors. The return air intakes, immediately below the outlets, are oversize. Two or three air units are grouped together, to simplify the feed connections. Each unit has a drip pan and drain connection.

Each room has a thermostat and a small control box, with a dial.

Two 7½ hp unit air conditioners installed on the roof cool the ballroom. ⊣

How U. S. Govt. Determines Need for Air Conditioning

BY CHESTER H. HOSMER

Design and Construction Div.
General Services Administration

THE QUESTION of which parts of the country are hot enough to warrant the installation of air conditioning equipment is not a new one to the Federal Government. In the Public Buildings Service, of the General Services Administration, the search for a logical means of comparing one climate with another, and evaluating the relative degrees of discomfort in hot weather, began as long as 20 years ago. (The agency was then the Public Buildings Branch of the Procurement Division, Treasury Department). At that time very few Government owned buildings outside of Washington, D. C., had been air conditioned and selection of buildings to be air conditioned was generally based on rather arbitary geographical boundaries.

Air Condition Where Ventilation Fails to Give Comfort

The accompanying map (Design Data Sheet 30-6-2A) was devised in 1946 to provide a more equitable basis for allotting limited funds for air conditioning. Of the various climatic elements that could have been represented, only the outside dry bulb temperature and outside wet bulb temperature were considered. The elimination of other factors was based on the assumption that air conditioning should be applied only where ventilation with high rates of air change would fail to provide indoor comfort. Solar radiation was excluded because at high ventilation rates its effect on temperature rise would not be large, and no tested method of combining it mathematically with other factors was available. Wind velocity was not considered because the air velocity within a building is controllable by mechanical means and is not necessarily dependent on outside wind velocity.

In order to have a map with a single variable, it was desired to combine the selected climatic factors, dry bulb temperature, and wet bulb temperature. The use of true effective temperatures would have involved the tabulation of thousands of simultaneous hourly readings of dry bulb and wet bulb temperatures, for which time and money were not available. The expedient of combining design dry bulb and design wet bulb temperatures was, therefore, adopted. While it was recognized that this introduced an unknown error into the results, it was considered sufficiently accurate.

Effective temperatures corresponding to the various combinations of design dry bulb and wet bulb temperatures were read from the American Society of Heating and Air-Conditioning Engineers' comfort chart, using the 20 to 30 fpm velocity line.

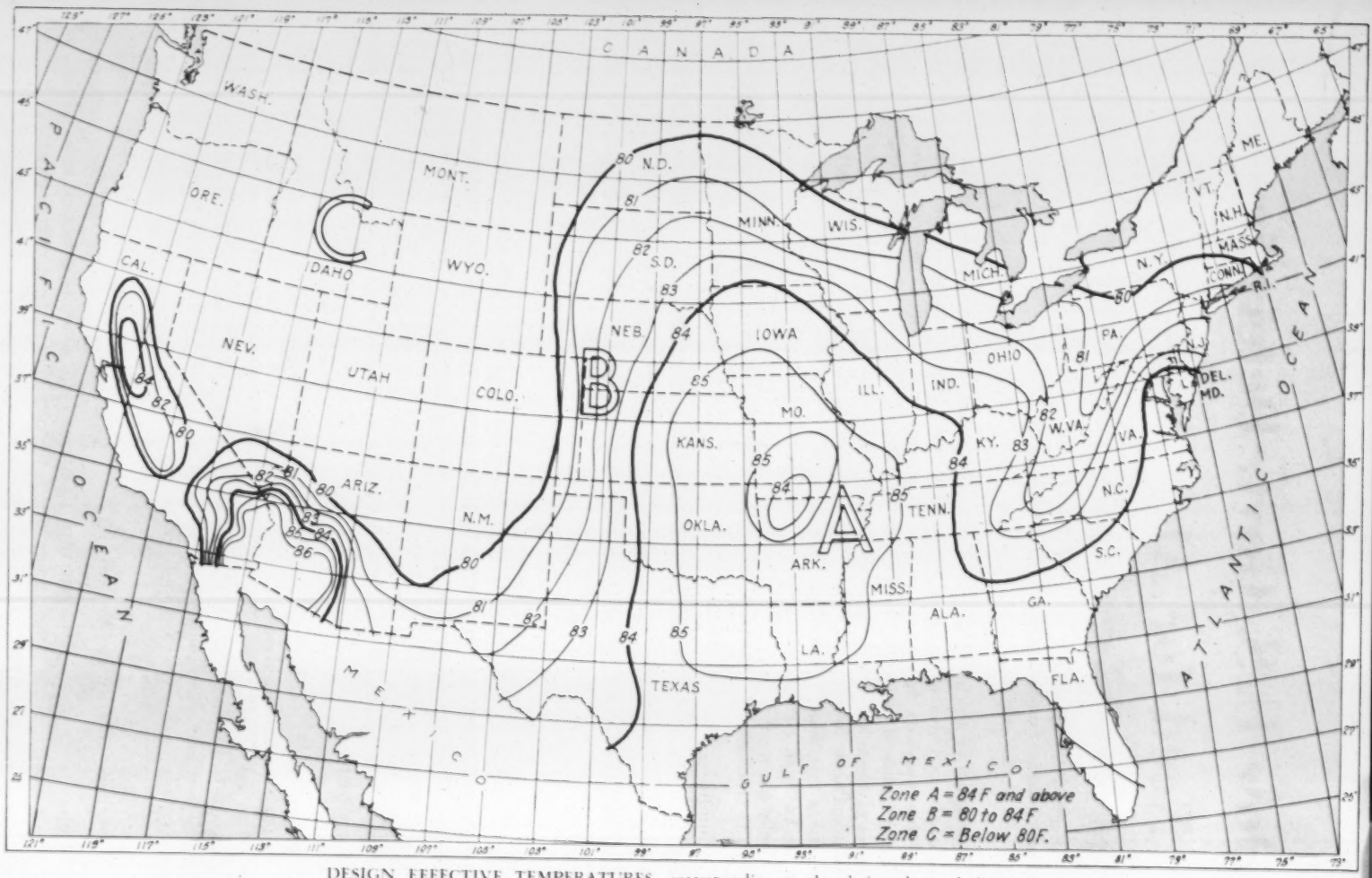
Discover Irregularities in Method

The use of the map for the past 10 years has indicated some irregularities. It is believed that this is due to two factors. One is the combining of temperatures which do not represent simultaneous readings and the other is the use of design temperatures — temperatures that are exceeded not more than a low percentage of the time during a given period.

It is hoped that modern electronic methods can be used by the Weather Bureau to provide, at a reasonable cost, tables showing the number of hours per year during which various effective temperatures are equaled or exceeded. With this data a new map could be drawn showing those effective temperatures which are exceeded for a considerably greater proportion of the time than approximately 5 percent, say 50

Tear out along this line

HPAC DATA SHEET



DESIGN EFFECTIVE TEMPERATURES, corresponding to the design dry and design wet bulb temperatures, are used by the General Services Administration in determining the need for air conditioning. Other factors are omitted on the assumption that air conditioning should be applied only where ventilation with high air change rates would fail to provide comfort

percent. Such a map should have fewer of the irregularities found in the present map.

The use of the term "Effective Temperature" for the combination of outdoor dry bulb and wet bulb temperatures has been criticized on the ground that effective temperature as ordinarily used applies only to indoor conditions. As used in this case the term does not represent all possible factors in either indoor or outdoor conditions, and a new term such as "Combined Outdoor Temperature" probably will be used in any future revision of the map.

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HEATING, PIPING & AIR CONDITIONING
AMERICAN SOCIETY OF
HEATING AND AIR-CONDITIONING ENGINEERS
Journal Section

The object of the Society is to advance the arts and sciences of heating, ventilating, cooling and air conditioning, and the allied arts and sciences, for the benefit of the general public, to encourage and conduct scientific research, and to cooperate with other organizations having the same or similar objectives.

Revised Winter Outside Design Temperatures

By H. C. S. Thom*, Washington, D.C.

SUMMARY — The problem of developing design temperatures is discussed in general terms. Simplifying assumptions are introduced which make possible the development of design values from available information. Climatological analysis is applied on the basis of these assumptions. This provides a range of design values which offers the advantage of flexibility in application. The proposed values have the property that the central value of this range is consistent on the average with present design practice. A proposed set of design values is given for most cities now provided for by THE GUIDE of ASHAE.

A WINTER outside design temperature may be defined as an outside temperature which, when used in the design of a heating system, will assure with a given contingency that the system will adequately meet a set of prescribed design requirements. It is clear that the choice of outside temperature for design purposes depends on the assignment of the prescribed design requirements and on the contingency involved. The assignment of the prescribed design requirements is an engineering problem while the determination of the contingency is a climatological problem. If there were no contingency associated with the climatological variable, the design problem would involve only the contingency on the engineering factors and this could usually be made small without increasing the engineering factors beyond reasonable economic limits. Thus, the main contingency in the design of heating systems arises from the variability of the weather. This must be handled by climatological analysis.

There have been a number of published studies of the outside design temperature problem. These will not be discussed in detail here since the basic hypotheses used in this paper are believed to be somewhat different from those previously considered. This does not mean that the design values proposed here are unrelated to those previously discussed, but only that the proposed design values are believed to be more rationally related to design experience and, in fact, are governed to a considerable extent by that experience.

The Design Variable

For purposes of generalizing the discussion, use will be made of the concept of a design variable. (See Reference 1 for discussion of another application). This is defined as a variable quantity which is rationally related to the design problem and can vary over a scale of contingency and a range of the prescribed design requirements. A particular value of the design variable under consideration would be a chosen design temperature. Clearly this temperature depends on a specific value of the contingency and on the prescribed design requirements. The problem of developing a design variable consists then in finding a variable which is rationally related to the elements of the design problem, and in defining

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For presentation at the 63rd Annual Meeting of the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, Chicago, February 1957.

functions or relationships on the design variable which relate it to the contingency and the prescribed design requirements. Hence, given a set of design requirements and a contingency on adequacy, these may be related to the design value.

The foregoing discussion may be more clearly expressed by using the language of function symbolism. The prescribed design requirements are summarized in the inside design temperature. This may be expressed as

$$t_{iD} = j\,(a, b, c, \ldots)$$

where

$a, b, c, \ldots$ = any set of design requirements.
t_{iD} = an inside design temperature.
j = a function relating t_{iD} and $a, b, c, \ldots$.

Associated with t_{iD} is a contingency or probability, q, which is the probability with which a failure of the system to meet the load accompanying t_{iD} can be tolerated. We shall assume that t_{iD} and q are given since their determination is beyond the scope of this paper.

Let t_i be any inside temperature which is produced when the heating system is operating against an outside temperature t_o. There are conventional engineering methods which make possible the relating of t_i to t_o by a function, say g. This may be expressed by the functional relationship

$$t_i = g\,(t_o) \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

For a specific inside design temperature t_{iD} there will be an outside design temperature t_{oD} given by Equation 1 in the relation

$$t_{iD} = g\,(t_{oD}) \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

This may be determined explicitly by the inverse of Equation 2 given by

$$t_{oD} = g^{-1}\,(t_{iD}) \quad \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Now by climatological analysis a probability distribution, F, may be defined on t_{oD} such that p is the probability of an outside temperature t_o being less than t_{oD}. This is given by

$$p = F\,(t_{oD}) \quad \ldots\ldots\ldots\ldots\ldots\ldots (4)$$

Substituting the value of t_{oD} from Equation 3 into Equation 4 gives

$$p = F\,[g^{-1}\,(t_{iD})] \quad \ldots\ldots\ldots\ldots (5)$$

Taking the inverse it is found that

$$g^{-1}\,(t_{iD}) = F^{-1}(p) \quad \ldots\ldots\ldots\ldots\ldots (6)$$

and

$$t_{iD} = g\,[F^{-1}(p)] \quad \ldots\ldots\ldots\ldots\ldots (7)$$

Thus it is seen that each t_{iD} is associated with a p on t_{oD} and if p is set equal to q (as defined earlier in this paper), the probability of an outside temperature being less than t_{oD} is equal to the probability of the inside temperature being less than t_{iD}. Hence Equation 6 determines an outside design temperature t_{oD} by means of a probability on t_{iD}.

While Equation 6 gives a simple symbolic solution to the design temperature problem, the real situation is somewhat more complicated. Actually the function $g\,(t_o)$ is a simplification of the real situation. Although g is ordinarily assumed to be a function of a t_o which is constant long enough to allow t_i to attain an equilibrium value, actually t_o is always varying with time. Since t_i lags behind t_o because of heat storage in the structure and t_o is often at its minimum only a short time, t_i may not reach the minimum defined by $g\,(t_o)$. Hence, in general, $t_i \geq t_{iD}$ when $t_o = t_{oD}$. This has the effect of making $q < p$; or if p is set equal to q, the actual inside design temperature will be somewhat greater than given by the function g when heat storage of the structure cannot be taken into account.

Because t_o has a diurnal cycle as well as an annual cycle, the exact definition of t_{oD} is a complex problem. If, however, the function g accounted for all factors in the relation between t_i and t_o, the design variable could be defined much more exactly. Unfortunately this would be a very complicated function which is not available in exact form at the present state of engineering science. Hence, in order to arrive at a generally useful set of design data, certain simplifying assumptions must be made. The complexity of g may then be allowed for by giving a range of design values, each with its associated probability, from which the engineer may for most practical purposes account for a known form of g by simply choosing a probability which fits specific conditions. For example, if the heat storage of a structure is high, a higher t_{oD} and hence a higher probability may be chosen. If it is low, a lower t_{oD} and a lower probability would be chosen.

The first simplifying assumption (assumption I) made is that the greatest stress on the heating system will occur when the average temperature, for a day or a linear function of it, assumes its lowest value. This implies that if the heating system meets the load satisfactorily for the *day* with the lowest average temperature, or a linear function of it, it will also meet it for every other day during the year in which that *day* occurs. For example, suppose that in 3 particular years the coldest days as measured by the average temperature were January 15, February 10, and January 25, and a heating system met the load on all of these days, then it must have also met the load on all other days during the 3 years.

Observe that the assumption is not very restrictive, for as stated, the designer may make adjustments by varying probabilities. Note also that this clearly segregates the operating problem.

The second simplifying assumption (assumption II) is that the design temperatures in use for a good many years[1] are correct on the average over the country for a given contingency on the satisfactory design of heating systems, or if not correct, all are in error by a fixed probability difference. A consideration of these two assumptions together leads to a rational choice of design variable which can be made to fit various prescribed design requirements and at the same time account for known

[1]Exponent numerals refer to References.

changes in the function g by simply varying the probability which according to Equation 4 also implies a change in t_{oD}.

The analysis now proceeds as follows: Using assumption I, a probability distribution F is defined on t_o where t_o is the set of lowest annual daily average temperatures. The probability distributions for a sample of cities for which design temperatures are desired (and for which the present design temperatures are known) are then fitted for each city of the sample. From this set of distributions a single probability is chosen such that the t_{oD} determined by the F's are equal on the average to the present design temperatures[1]. This is chosen as the central design value to which are added four temperatures: two with probabilities below the central value and two with probabilities above. This produces a

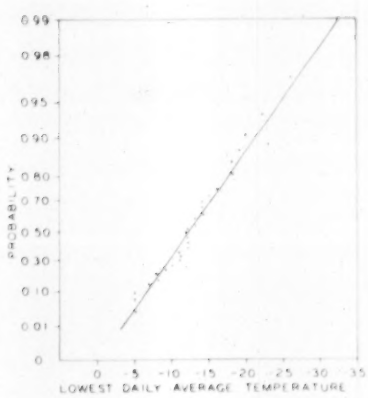

Fig. 1—Example of method used in fitting a frequency curve from Equation 8 to 30-year records for 23 cities (curve is for Minneapolis)

set of 5 design values with varying probabilities. The central values are equal on the average to present design values and are homogeneous with respect to probability, as will be seen later. The additional 4 values allow the engineer freedom in choosing a design value better suited to his knowledge of g and prescribed design requirements, by moving up or down from the central value with which he has had long experience. Should he have no special detailed knowledge about g or his prescribed design requirements, he may still use the central value with assurance that he is not departing from present design practice[1] except in the instances where present values are excessively biased.

Climatological Analysis

The problem of climatological analysis is to determine the function F of Equation 4. This consists in fitting a theoretically suitable frequency curve to the t_o for each city for which design data are required. The t_o are extreme (or minimum) annual values which are a sample from a much larger set of temperatures, *i.e.* each year has 365 daily average minima from which one minimum is chosen. It is reasonable to expect, therefore, that the Type I extreme value distribution theory will apply[2]. This distribution is given by the equation

$$F(t_o) = e^{-e^{-(t_o - t_0)/\beta}} \qquad (8)$$

where

$F(t_o)$ = the probability of $t < t_o$ (see Equation 4).
e = the base of natural logarithms.
α and β = parameters of the distribution.

The statistical problem consists in estimating satisfactory values of α and β from a series of values of t_o. Lieblein[3] has provided a method of fitting Equation 8 which was found to be very satisfactory for this purpose. Since the method of fitting is discussed in detail by Lieblein, it is not necessary to discuss it here. It may be said, however, that the method is very simple, although it should be mentioned that Lieblein only discusses the fitting of maxima so an adjustment must be made to his methods for fitting to minima as required here.

In preparing the design values presented here, the distribution of Equation 8 was first fitted to 30-year records ending in 1950 (standard normal period) for a well distributed climatic sample of 23 cities.* An example of the fit obtained is shown for Minneapolis in Fig. 1. Here the empirical probabilities determined from the samples are plotted as points on a special probability paper which make data which are distributed as Equation 8 plot on a straight line. The line shown in Fig. 1 is the theoretical line obtained from the values of α and β estimated by Lieblein's method. It is seen that the empirical points fit the line very well. This was found to be the case in all 23 cities analyzed in detail.

It should be noted that the probabilities given on the ordinate of Fig. 1 are the probabilities of an annual

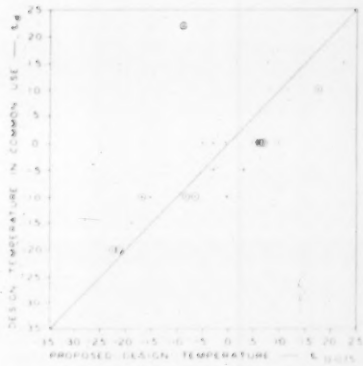

Fig. 2—Relation of design temperature in common use, t_0, and proposed outside temperature based on 0.075 probability, $t_{0.075}$, for 23 cities

lowest average temperature being greater than a value read on the abscissa. For the design problem probabilities of being lower than a particular value are required; hence the complements of the probabilities of Fig. 1 are needed. These are given by simply subtracting those on the ordinate from one. For example, reading from Fig. 1, the temperature corresponding to a probability of 0.95 is −25 F. Subtracting 0.95 from one gives 0.05 which corresponds to the value given for Minneapolis in Table 1.

Proposed Winter Design Data

Using assumption II proposed in the discussion of the design variable, a value of probability on t_o was found for the 23 sample stations such that the present design temperature t_0 is equal on the average to a new t_o. This is labelled $t_{0.075}$ in Fig. 4.

*These 23 cities are designated with asterisks in Table 1.

2 where the points for the 23 cities are plotted. The line indicates the equality of the 2 design temperatures and averages the relationship within the limits of sampling variability and bias in the present design data t_d. The circled points are those for which the $t_{0.975}$ given by THE GUIDE[1] are also available. The probability on t_o

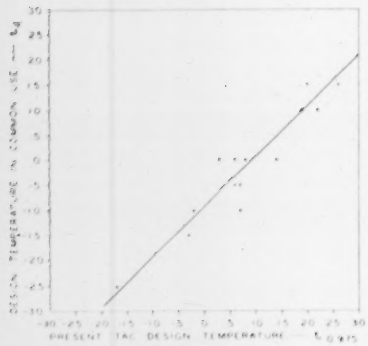

Fig. 3—Relation of design temperature in common use, t_o, and present TAC design temperature, $t_{0.975}$, based on 0.025 probability for 14 cities

which made t_o equal to t_d on the average is 0.075. This is equivalent to an occurrence of about once in 13 years which seems to be a reasonable estimate of the probability of a system's failure to meet a load using the presently available design data. This was therefore adopted as the central value for $t_{0.9}$ not only because of its reasonable probability but because of its relation to t_d on which a long experience in heating system design has accumulated.

Four other values of probability were then chosen to bracket the $t_{0.975}$ and give flexibility along the design variable scale. This allows for other design requirements and the use of greater knowledge of the function g under specific circumstances. Two greater probabilities were chosen, 0.10 and 0.20, and 2 lesser probabilities, 0.05 and 0.025. This seemed to be a reasonable selection which was made in cooperation with the TAC on Weather Data. (Actually there is no real limitation on the number of

Table 1 — Proposed Outside Design Temperature Data, $t_{o.9}$, for Various Risks Based on the Distribution of the Lowest Daily Average Temperature

(Cities designated with asterisks indicate those for which data are plotted in Figs. 2, 5, and 4)

Col. (1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
State	Station	Probability of Lower Temperature					Guide Design, t_d	Into 0.975 Minus t_o*
		0.025 $t_{0.025}$	0.05 $t_{0.05}$	0.075 $t_{0.075}$	0.10 $t_{0.10}$	0.20 $t_{0.20}$		
ALA.	Anniston	5	9	12	14	18	5	−7
	Birmingham	6	10	12	14	18	10	−2
	Mobile	17	20	22	24	27	15	−7
	Montgomery	11	15	18	19	25	10	−8
ARIZ.	Flagstaff	−12	−7	−4	−2	3	−10	−6
	Phoenix	35	35	36	37	39	25	−11
	Yuma	34	36	38	39	41	30	−8
ARK.	Bentonville	−8	−4	−1	0	5	—	—
	Fort Smith	4	7	9	11	14	10	1
	Little Rock	6	10	12	13	16	5	−7
CALIF.	Eureka	28	30	32	33	35	30	−2
	Fresno	29	31	32	32	34	25	−7
	Independence	−6	−2	1	3	8	—	—
	Los Angeles	37	39	41	41	44	35	−6
	Sacramento	27	29	30	31	33	30	0
	San Diego	41	42	43	44	46	35	−8
	San Francisco	34	36	37	38	40	35	−2
COLO.	Denver	−20	−15	−12	−10	−5	−10	2
	Durango	−17	−11	−8	−6	0	—	—
	Grand Junction	−11	−6	−3	−1	4	−15	−12
	Leadville	−15	−12	−10	−9	−5	—	—
	Pueblo	−24	−18	−14	−12	−5	−20	−6
CONN.	Bridgeport	−6	−3	−1	1	4	—	—
	Cream Hill	−12	−9	−7	−6	−2	—	—
	Hartford	−7	−4	−2	0	3	0	2
	New Haven	−5	−2	0	1	5	0	0
	New London	−2	1	3	4	7	—	—
	Norwalk	−7	−5	−1	0	4	—	—
D. C.	Washington*	5	8	10	11	14	0	−10
FLA.	Jacksonville	24	27	28	30	33	25	−3
	Key West	50	52	53	54	56	45	−8
	Pensacola	19	22	24	25	29	20	4
	Tampa	32	35	36	38	41	30	−6
GA.	Atlanta*	5	9	11	13	17	10	1
	Augusta	15	18	20	21	25	10	−10
	Macon	14	18	20	21	24	15	−5
	Savannah	19	22	24	25	28	20	4
IDAHO	Boise	−20	−14	−10	−7	0	−10	0
	Lewiston	−24	−16	−12	−8	0	5	17
	Pocatello	−27	−20	−17	−14	−7	−5	12
ILL.	Cairo	−8	−3	0	2	7	0	0
	Chicago	−17	−13	−11	−9	−5	−10	1
	Peoria	−20	−15	−13	−11	−6	−10	3
IND.	Evansville	−12	−7	−4	−2	3	—	—
	Fort Wayne	−13	−9	−7	−5	−2	−10	−3
	Indianapolis	−14	−10	−8	−6	−1	−10	−2
	Lafayette	−15	−11	−8	−6	−1	—	—
	Terre Haute	−12	−8	−6	−4	0	—	—
IOWA	Charles City	−28	−24	−21	−20	−16	—	—
	Davenport	−18	−14	−12	−10	−5	−15	−3
	Des Moines	−19	−15	−13	−12	−8	−15	−2
	Dubuque	−22	−18	−15	−14	−9	−20	−5
	Keokuk	−21	−16	−13	−11	−6	—	—
	Sioux City	−22	−18	−16	−15	−11	−20	−4
KAN.	Concordia	−17	−13	−11	−9	−5	−10	1
	Dodge City	−16	−11	−9	−7	−2	−10	−1
	Iola	−15	−10	−7	−5	0	—	—
	Topeka	−15	−11	−8	−7	−2	−10	−2
	Wichita	−13	−9	−6	−4	0	−10	−4
KY.	Bowling Green	−7	−1	2	5	11	—	—
	Hopkinsville	−7	−1	2	4	10	—	—
	Irvington	−8	−5	0	5	8	—	—
	Lexington	−9	−5	−2	−1	4	—	—
	Louisville	−9	−5	−2	0	4	0	2
	Shelbyville	−9	−4	−1	1	7	—	—
LA.	New Orleans	21	24	26	27	30	20	−6
	Shreveport	8	12	14	16	20	20	6
ME.	Eastport	−14	−11	−9	−8	−5	−10	−1
	Portland	−15	−11	−9	−7	−3	−5	4
MD.	Baltimore	5	6	8	9	13	0	−8
MASS.	Boston*	−6	−2	0	1	4	0	0
MICH.	Alpena	−16	−12	−10	−8	−5	−10	0
	Detroit	−10	−6	−4	−3	1	−10	−6
	Escanaba	−25	−21	−18	−17	−12	−15	3
	Grand Haven	−8	−5	−3	−1	2	—	—
	Grand Rapids	−9	−6	−4	−2	1	−10	−6
	Houghton	−24	−20	−18	−16	−11	—	—
	Lansing	−14	−10	−8	−7	−3	−10	−2
	Ludington	−13	−9	−7	−5	−1	—	—
	Marquette	−22	−18	−16	−14	−10	−16	6
	Sault Ste. Marie	−24	−21	−19	−17	−14	−20	−1

Table 1 (Continued)—Proposed Outside Design Temperature Data, $t_{0.0}$, for Various Risks Based on the Distribution of the Lowest Daily Average Temperature

(Cities designated with asterisks indicate those for which data are plotted in Figs. 2, 3, and 4)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
State	Station	Probability of Lower Temperature					Guide Design, t_d	$t_{0.075}$ at 0.075 Minus t_d*
		0.025	0.05	0.075	0.10	0.20		
		$t_{0.025}$	$t_{0.05}$	$t_{0.075}$	$t_{0.10}$	$t_{0.20}$		
MINN.								
	Duluth	−32	−29	−27	−25	−22	−25	2
	Minneapolis*	−28	−25	−23	−21	−18	−20	3
	Moorehead	−35	−32	−29	−27	−23	—	—
	St. Paul	−28	−25	−23	−21	−18	−20	3
MISS.								
	Corinth	−2	4	8	11	18	—	—
	Meridian	8	12	14	16	20	10	−4
	Vicksburg	9	13	15	17	21	10	−5
MO.								
	Columbia*	−16	−11	−9	−7	−2	−10	−1
	Hannibal	−19	−14	−12	−9	−4	—	—
	Kansas City	−15	−11	−8	−6	−2	−10	−2
	St. Louis*	−12	−8	−5	−3	1	0	5
	Springfield	−12	−8	−5	−4	1	—	—
MONT.								
	Billings*	−42	−35	−31	−28	−21	−25	6
	Havre	−49	−43	−39	−35	−29	−30	9
	Helena	−55	−44	−39	−36	−27	−20	19
	Kalispell	−45	−35	−31	−27	−19	−20	11
	Miles City	−44	−38	−35	−32	−26	−35	0
NEB.								
	Lincoln*	−22	−18	−15	−14	−9	−10	5
	North Platte	−21	−17	−15	−13	−9	−20	−5
	Omaha	−24	−19	−17	−15	−10	−10	7
	Valentine	−27	−23	−21	−19	−15	−25	4
NEV.								
	Reno*	4	0	5	5	9	−5	−8
	Winnemucca	−17	−12	−9	−6	0	−15	−6
N. H.								
	Concord	−17	−15	−11	−9	−5	−15	4
N. J.								
	Atlantic City	3	6	8	9	12	5	−3
	Elizabeth	−4	1	5	5	10	—	—
	Flemington	−5	0	5	5	10	—	—
	New Brunswick	−1	3	5	7	11	—	—
	Plainfield	−2	2	4	6	10	—	—
	Somerville	−6	−2	1	3	8	—	—
	Trenton	−4	0	2	3	7	0	−2
N. M.								
	Albuquerque	3	6	8	10	14	0	−8
	Roswell	−4	1	4	6	11	−10	−14
	Santa Fe	−5	0	2	4	9	—	—
N. Y.								
	Albany	−16	−12	−9	−8	−4	−10	−1
	Binghamton*	−12	−9	−7	−5	−2	−10	−3
	Buffalo	−11	−7	−5	−4	0	−5	0
	Canton	−28	−25	−22	−21	−17	−25	−3
	Ithaca	−9	−6	−4	−5	0	−15	−11
	New York*	1	3	5	6	9	0	5
	Oswego	−12	−9	−7	−5	−1	−10	3
	Rochester	−9	−6	−4	−3	1	−5	1
	Syracuse	−16	−12	−10	−8	−4	−10	0
N. C.								
	Asheville	−2	2	5	6	11	0	−5
	Charlotte	9	12	14	16	19	10	−4
	Hatteras	16	19	21	22	25	—	—
	Raleigh	9	12	14	15	18	10	−4
	Wilmington	16	19	20	22	25	15	−5
N. D.								
	Bismarck	−48	−44	−41	−39	−34	−50	1
	Devils Lake	−47	−44	−42	−40	−37	−50	2
	Grand Forks	−43	−39	−36	−34	−30	—	—
	Williston	−44	−38	−35	−33	−27	−35	0
OHIO								
	Cincinnati	−9	−5	−3	−1	3	0	3
	Cleveland	−11	−7	−5	−3	1	0	5
	Columbus	−9	−5	−3	−2	2	−10	−7
	Dayton	−10	−6	−4	−2	2	0	4
	Sandusky	−10	−6	−4	−2	2	0	4
	Toledo	−11	−7	−5	−4	0	−10	−5
OKLA.								
	Oklahoma City	−9	−4	−1	1	6	0	1
ORE.								
	Baker	−24	−17	−14	−11	−5	−5	9
	Portland	1	7	10	12	18	10	0
	Roseburg	14	17	19	20	24	10	−9
PA.								
	Erie*	−9	−5	−3	−2	2	−5	−2
	Harrisburg	0	2	4	5	8	0	−4
	Philadelphia*	1	4	6	7	11	0	−6
	Pittsburgh*	−9	−6	−5	−2	2	0	−5
	Reading	−2	1	3	4	8	0	−3
	Scranton	−8	−4	−2	−1	3	−5	−3
R. I.								
	Block Island*	3	5	7	8	10	0	−7
	Kingston	−5	−2	0	1	4	—	—
	Providence	−4	−1	1	2	5	0	−1
S. C.								
	Charleston*	17	20	22	23	27	15	−7
	Columbia	14	17	19	20	24	10	−9
S. D.								
	Huron*	−27	−23	−21	−20	−17	−20	1
	Pierre	−22	−19	−17	−15	−12	—	—
	Rapid City	−28	−24	−22	−20	−16	−20	2
TENN.								
	Chattanooga*	0	5	8	10	14	10	2
	Knoxville	−3	2	5	7	12	0	−5
	Memphis	0	4	6	8	13	0	−6
	Nashville	−4	0	5	5	10	0	−5

probabilities obtainable since the distributions are available for all cities in Table 11. These then gave rise to the associated $t_{0.0}$: $t_{0.20}$, $t_{0.10}$, $t_{0.05}$, and $t_{0.025}$ by the inverse of Equation 4, giving chances of one in 5, 10, 20, and 40 years. This set of values is given in Table 1 of the proposed design temperatures together with present design temperatures which may be compared with the central value $t_{0.0} = t_{0.075}$. The difference $t_{0.075} - t_d$ is also given for ready comparison. The latter average close to zero for the entire table, showing that $t_{0.075}$ is equal on the average to t_d.

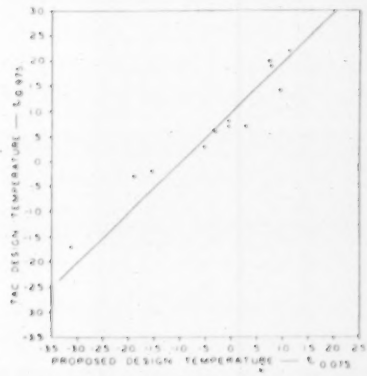

Fig. 4—Comparison of present TAC design temperature and proposed design temperature for 13 cities

There are a number of striking examples of bias in the present design temperatures. For example, Table 1 shows the same design temperature as in THE GUIDE for Washington, Philadelphia, New York, and Boston, all zero. This appears strange when the variation in climate among these 4 cities is considered. The proposed central design values place these in proper climatic order: Washington 10 F, a value reported to be often used, Philadelphia 6 F, New York 5 F, and Boston 0 F. Boston remains the same as the present value in THE GUIDE. Other homogenization may be noted by those interested in design for particular areas.

Two other comparisons were made with published design values. In Figs. 3 and 4 the $t_{0.975}$ as given in THE

Table 1 (Concluded)—Proposed Outside Design Temperature Data, $t_{0.99}$, for Various Risks Based on the Distribution of the Lowest Daily Average Temperature

(Cities designated with asterisks indicate those for which data are plotted in Figs. 2, 3, and 4)

Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8	Col. 9
State	Station	Probability of Lower Temperature					Guide Design, t_d	Col. 8 Minus 0.075 Minus $t_{0.99}$*
		0.025	0.05	0.075	0.10	0.20		
		$t_{0.025}$	$t_{0.05}$	$t_{0.075}$	$t_{0.10}$	$t_{0.20}$		
Tex.	Abilene*	0	5	7	9	14	15	8
	Amarillo	−10	−5	−2	0	5	−10	−8
	Corpus Christi	16	20	23	24	29	20	−3
	Dallas	1	6	8	10	15	0	−8
	El Paso	15	18	20	21	25	15	−5
	Fort Worth	0	5	8	10	15	10	2
	Galveston	16	20	23	24	29	20	−3
	Houston	15	17	19	21	25	20	1
	Palestine	4	8	11	13	18	15	4
	San Antonio	12	16	19	20	25	20	1
	Taylor	5	9	12	14	19	—	—
Utah	Salt Lake City*	−8	−5	−1	1	6	−10	−9
Vt.	Burlington*	−23	−19	−17	−15	−11	−10	7
	Northfield	−24	−21	−19	−17	−13	—	—
Va.	Cape Henry*	13	16	17	18	21	10	−7
	Lynchburg	7	10	11	12	15	5	−6
	Norfolk	11	14	15	17	20	15	0
	Richmond	6	9	11	12	16	15	4
	Wytheville	−5	1	3	4	8	—	—
Wash.	Seattle	9	13	15	17	21	15	0
	Spokane	−28	−20	−16	−13	−5	−15	1
	Tacoma	9	13	15	16	20	15	0
	Tatoosh Island	12	16	18	20	25	15	−3
	Walla Walla	−23	−16	−12	−8	−1	—	—
W. Va.	Elkins	−10	−7	−4	−3	1	−10	−6
	Parkersburg	−7	−3	−1	1	5	−10	−9
Wis.	Green Bay	−27	−23	−20	−18	−14	−20	0
	La Crosse	−27	−23	−20	−19	−14	−25	−5
	Madison	−25	−21	−19	−17	−13	−15	4
	Milwaukee	−24	−20	−17	−15	−10	−15	2
Wyo.	Cheyenne*	−26	−22	−19	−17	−12	−15	4
	Lander	−39	−33	−30	−27	−21	−18	12
	Yellowstone Park	−45	−38	−34	−30	−23	—	—

*Col. 5 minus Col. 8.

GUIDE for the cities corresponding to the circled points (Fig. 2) are compared with the central design value $t_{0.075}$ and the design value in common use t_d. (Note that $t_{0.975}$ is $t_{0.025}$ in the nomenclature employed here since probabilities are for failure to meet load, or 1 − 0.975. This is *not* equal to $t_{0.025}$ of the proposed design values). The comparisons show why the $t_{0.975}$ has not been very popular, for it gives design values about 10 deg higher on the average than both the values in common use and the proposed central values, yet it has a lower probability, 0.025 as compared to 0.075. To obtain values on this design variable comparable to present practice would require lowering the probability to values which are inconsistent with reasonable risk or contingency for heating system design. These lower probabilities would also be difficult to estimate accurately from available data.

It will be recalled that the $t_{0.975}$ is the temperature for which the average proportion of hours above $t_{0.975}$ is 0.975 during the winter season December, January, and February. This may still have uses, which up to the present time have not been developed. As seen in Figs. 3 and 4, it may be obtained from a relationship established with either $t_{0.075}$ or t_d. This is the subject of a study by John Everetts, Jr., Philadelphia, Pa., who has given it much more thorough consideration.

Although this discussion has meant to carefully avoid discussing load problems except for pointing out difficulties which affect the choice of a basis for design temperatures, 2 suggestions on the use of data in the proposed form might be helpful. In cases where the designer has a limited knowledge of g and the prescribed design requirements, for example, in a structure which could be later used for unanticipated purposes, a smaller probability within economic restrictions could be considered. A second instance might be to differentiate the use of the structure by the probabilities. For example, a hospital might naturally call for a smaller probability of failure to meet load than an office building. Many other applications of the flexibility provided by a range of design values, in contrast to a single value, would be found by the designer as experience in use is developed.

Acknowledgments

The author wishes to express appreciation for many constructive discussions with members of the TAC on Weather Data and more especially for the helpful suggestions and interest of Mr. Everetts, the chairman, Scott Heider, staff engineer, Building Research Advisory Board, and P. R. Achenbach, chairman of the TAC on Heating Load. Sincere appreciation must also go to Daniel Harton of National Weather Records Center, Asheville, and to my statistical assistant, Maurice Kasinoff, for carrying out all computations.

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Performance of Covered Hot Water Floor Panels

Part II — Room Conditions

By E. L. Sartain*, Racine, Wis., and W. S. Harris**, Urbana, Ill.

SUMMARY — This paper, which is divided into 2 sections, is the second of a series concerning the panel heating investigation being conducted at the University of Illinois in cooperation with the *Institute of Boiler and Radiator Manufacturers*. The scope of these papers is limited to studies of concrete panels at grade level.

Part I contained a discussion of the effects of various floor coverings on the thermal characteristics of floor panels, while Part II is concerned with the room conditions. Studies of room conditions include consideration of room-air temperature and velocity; slab, floor covering, wall, glass and ceiling surface temperatures; heat flow from panel to room; and relative humidity produced in the test rooms.

IN AN EARLIER paper[1] the Floor Slab Laboratory was described. In Part I of this paper[2], details were set forth covering (*a*) the heating installation, (*b*) the nature of the floor coverings used and their method of installation, (*c*) the instrumentation of the laboratory, and (*d*) the operating conditions maintained during the tests. The data presented here were all obtained in this same laboratory, using the same equipment and the same methods.

Room-Air Temperature and Velocity Distribution

Air temperatures were measured in each test room at levels 3, 12, 30, 60, 81 and 93 in. above the floor. At the center of the room, the maximum temperature difference between the various levels was obtained by subtracting the lowest temperature from the highest irrespective of distance above the floor. These are correlated with indoor-outdoor temperature difference in Table 1. About 35 tests were made in each case with indoor-outdoor temperature differences ranging from 63 to 15 F. A statistical analysis of the data showed that at 95 percent confidence level the average difference in room air temperature from 3 in. above the floor to 3 in. below the ceiling in Rooms A and B and at indoor-outdoor temperature difference of 80 F would not exceed 2.3 F. For Rooms C and D this variation would not exceed 3.8 F. Interchanging the floor coverings in Rooms C and D did not affect the air temperature difference.

The correlation of room-air temperatures as measured at the 30-in. level in the center of the room with the corresponding indoor-outdoor temperature difference are shown for each room in Table 1. The trend was for the room-air temperature to decrease slightly as the indoor-outdoor temperature difference increased. However, observations of the room-air temperature near the thermostat indicated that indoor-outdoor temperature difference had no effect on the room-air temperature at this location. Apparently the lower air temperature at the center of the room resulted from the circulation of cool air from the window which was not warmed to the normal room temperature.

Two days were selected in which average outdoor temperatures were about 37 F and 20 F, respectively, and the test points were very close to the average values from Table 1. Floor to ceiling temperatures at the center of the room were plotted for those days for all 4 test rooms (Fig. 1).

All room-air temperatures were corrected to a condition of 70 F at the 30-in. level for comparative purposes. Variations in temperature from floor to ceiling were small, and, except for floor-surface temperature, were virtually independent of outdoor temperature. Since the thermocouple at the 30-in. level in Room A was within a few inches of the thermo-integrator (surface temperature about 80 F), the indicated temperature at this point was probably high. Had the thermo-integrator not been present, probably the temperature curve in Room A would have more closely approximated that of Room B.

In Rooms C and D the temperature curves show (Fig. 1) a somewhat different shape from those in Rooms A and B. In Room C there was an increase in air temperature from the 3-in. level to the 30-in. level, while in Room D there was a slight decrease in temperature from the 3-in. level to the 12-in. level. The temperature at the 30-in. level in Room D was 0.6 deg to 1.2 deg higher than that 12 in. above the floor. Above the 30-in. level in all test rooms the room-air temperature was uniform for both moderate and low outdoor temperatures. When the outdoor temperature was 20 F, the room-air temperature 3 in. above the floor in Rooms A and B at a location 2 ft from the north wall was about 3 deg lower than the corresponding value at the center of the room; whereas in Rooms C and D the difference in air temperature at these locations was 1.5 deg to 2.5 deg lower. This was to be expected since a definite downward movement of cold air was noticeable at the north wall. This cool air continued to move across the floor toward the center of the room.

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[1]Exponent numerals refer to References.
For presentation at the 65rd Annual Meeting of the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, Chicago, Ill., February, 1957.

To determine qualitatively the velocity of air movement in the rooms, a heated wire anemometer capable of measuring air velocities as low as 10 fpm was used as a probe. Fig. 2 represents a cross-section of Room C with air speed, direction and temperature indicated. The air was cooled at the north wall and window, dropped to the floor, and then moved in the direction of the south wall with a comparatively high velocity.

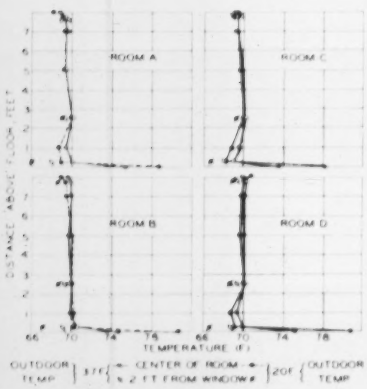

Fig. 1—Room air temperature profiles.

Passing along the floor the air was heated by the panel whereupon it rose and drifted back slowly toward the north wall. Circulation of air could occur only as a result of air temperature differences. The air temperatures were uniform throughout the room except for locations along the floor and north wall. Near the window and within 12 in. of the floor, velocity was high and temperature was low. In extreme cases this combination of high velocity and low air temperature will result in undesirable drafts.

Room-Air Temperature Control

To evaluate the ability of the heating system to control the room-air temperature at a given value, the maximum and minimum air temperatures occurring at the location of the thermostat during 24-hr periods were recorded. Plotting indicated no correlation between observed maximum-minimum temperature difference and indoor-outdoor temperature difference; therefore, the data were grouped and averaged according to operating conditions (Table 2).

The ability of the thermostat to control the room-air temperature at a given value depends upon the thermostat differential, the response of the panel (time required for the panel to heat and cool), the time lag for transient heat flow through the exposed walls and windows, and changes in the outdoor temperature. The thermostat differential setting and the outdoor temperature for any one test period was the same for all 4 test rooms. The time lags for transient heat flow through the north exposure in Rooms C and D were probably less than for Rooms A and B because of the larger window area. Because of this and the fact that the carpeted floor panels did not respond to load changes as quickly as did the bare panels, room-air temperatures in Rooms C and D were subjected to more variation than in Rooms A and B.

Effects of floor coverings and operating conditions on room temperature variations are best shown by a room-by-room analysis of Table 2. Columns 2 and 4 show that the thermostat in Room A was apparently set about 1.5 deg higher during the tests in Case IV than in Case III. Col. 6 shows that the average temperature variation in this room was about the same in both cases. Columns 3, 5 and 7 show the standard deviations (Sd) from the average values given in columns 2, 4 and 6, respectively. The standard deviation is a measure of the reproducibility of observations. Sixty-eight percent of all observations will normally be within ± one standard deviation of the average of all observations and 95 percent will be within ± two standard deviations. In Room A the standard deviations were about the same in Case IV as in Case III. Thus, it is apparent that while there was about a 1.5 deg change in the thermostat setting, the control of room-air temperature was not affected. In Room A the daily range of variation in room-air temperature at the thermostat was 0.5 to 1.3 deg for Case III and 0.6 to 1.6 for Case IV.

Table 1—Average Room-Air Temperatures[a] and Gradients[b]

Indoor-Outdoor Temp Diff	Room A		Room B		Room C		Room D	
	$t_c - t_f$	t_a	$t_c - t_f$	t_a	$t_c - t_f$	t_a	$t_c - t_f$	t_a
20	0.9 ± 0.2	71.1 ± 0.2	1.0 ± 0.1	71.1 ± 0.6	0.5 ± 0.1	71.5 ± 0.5	1.2 ± 0.2	71.6 ± 0.2
40	1.5 ± 0.1	70.6 ± 0.1	1.5 ± 0.1	71.1 ± 0.5	1.5 ± 0.1	70.4 ± 0.2	1.9 ± 0.1	71.4 ± 0.1
60	5.7 ± 0.2	70.1 ± 0.2	1.6 ± 0.2	71.1 ± 0.7	2.5 ± 0.2	69.6 ± 0.5	2.7 ± 0.2	71.2 ± 0.2
80	2.9 ± 0.5	69.6 ± 0.5	1.9 ± 0.5	71.1 ± 1.2	3.5 ± 0.5	68.7 ± 0.9	3.4 ± 0.4	71.0 ± 0.4

Note: Figures in table are for confidence limit of 95 percent.
(a) t_a — Air temperature at center of room 50 in. above floor.
(b) $t_c - t_f$ — Air temperature gradient in center of room, 5 in. below ceiling minus 5 in. above floor.

The standard deviations were about the same in Case IV as in Case III. Thus, it is apparent that while there was about a 1.5 deg change in the thermostat setting, the control of room-air temperature was not affected. In Room A the daily range of variation in room-air temperature at the thermostat was 0.5 to 1.3 deg for Case III and 0.6 to 1.6 for Case IV.

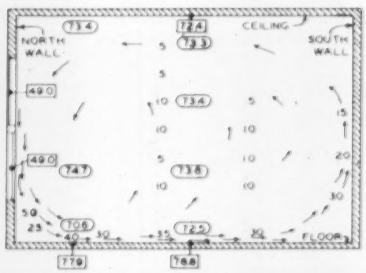

Fig. 2—Air temperature and velocity distribution in Room C, with outdoor temperature of 31 F. Numbers in ovals are air temperatures; those in rectangles are surface temperatures, both in Fahrenheit degrees. Other numbers represent air movements in fpm. Arrows represent direction of air movement.

Similar analyses were made for Rooms B, C, and D but are not included here.

Any change causing an increase in the values of Col. 5 of Table 2 will increase the variation in minimum air temperature occurring in the room at the end of the off-periods of the thermostat, thus making it necessary to increase the thermostat setting accordingly to insure that the room-air temperature remains above

a predetermined minimum value. Changes causing an increase in the values of Col. 3, Table 2 will increase the normal variations in maximum room-air temperature occurring at the end of thermostat on-periods. Such overruns in room-air temperature are usually due to heat storage within the panel. However, the rate of heat loss from the room resulting from differences in construction or differences in outdoor temperature may be a contributing factor. For example, when the carpets were interchanged in Rooms C and D the value in Col. 7 for Room C was increased even though the carpet was lighter. This was due to the warmer weather encountered during Case V than during Case IV. As the values in Col. 7 increase, room-air temperature becomes more erratic. Thus, for Case II, Room C, the normal maximum minus minimum room-air temperature difference was between 1.2 and 2.8 deg (Col. 8); whereas, in Case V it was between 2.3 and 6.5 deg.

One can conclude from Table 2 that the addition of carpets and pads over bare floor panels increased both the average maximum minus minimum room-air temperature difference and the standard deviation from this average. The maximum room temperatures (Col. 2) and standard deviations (Col. 3) were affected the most. In other words, other factors remaining constant, the addition of floor coverings to bare floor panels will reduce the ability of the system to maintain a constant room-air temperature. The greater the thermal resistance of the floor covering, the greater the resulting room-air temperature variation.

In order to show the effect of floor coverings on room-air temperature control with large outdoor temperature changes, a day was chosen during which there was a sharp decrease in outdoor temperature. Fig. 3 shows a plot of room-air and outdoor temperature *vs.* time for Rooms A, C and D for this day.

The room-air temperature for Room A (rubber tile) remained relatively constant even during the rapid change in outdoor temperature. However, such was not the case in Rooms C and D (carpet and pad). The thermostats started the heating systems at about 6:15 p.m. in Rooms C and D. Even so, the room-air temperatures continued to decrease until about 11:00 p.m. January 15. At this time they leveled off at a value some 3 to 4 deg lower than the thermostat setting and then began to climb. Heat was finally being supplied at a great enough rate to more than offset the increased room heat loss due to the outdoor temperature drop. The minimum room-air temperature occurred in Room C about one hour later than in Room D.

By 7:30 a.m. the thermostat in Room D was satisfied, but the thermostat in Room C continued to call for heat until about 9:15 a.m. At 8:30 a.m. and 2:30 p.m. the air temperatures in Rooms C and D reached their respective maximum values. While the maximum room-air temperature in Room D occurred one hour after the heater went off, the maximum room-air temperature in Room C occurred about 5 hr after the heater went off due to the increased heat storage in the panel and the less severe exposure in Room C. After the outdoor temperature became relatively constant, the room-air temperature in all test rooms became more stable. Much better control of room-air temperature was afforded in Room A than in Rooms C

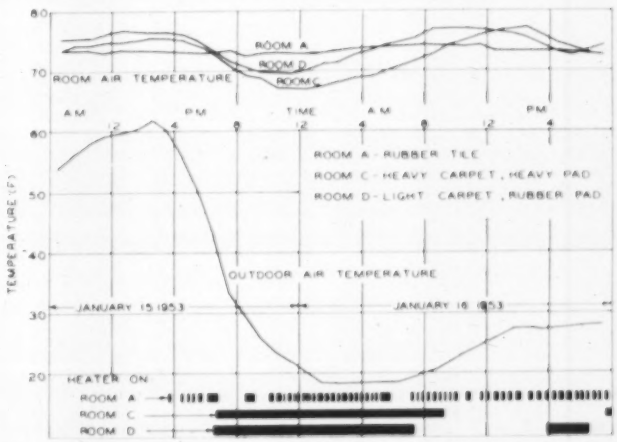

Fig. 3—Control of room air temperature with rapid changes in outdoor temperature

Table 2—Room-Air Temperatures

(1) Case	(2) Avg Max Temp., F	(3) Sd (Max)	(4) Avg Min Temp., F	(5) Sd (Min)	(6) Avg Max — Min, F	(7) Sd Max — Min	(8)* Variation in Room Air Temp., F
Room A							
III	72.2	0.5	71.3	0.3	0.9	0.4	0.5 — 1.3
IV	75.9	0.6	72.8	0.5	1.1	0.5	0.6 — 1.6
Room B							
III	72.7	0.6	70.5	0.6	2.2	0.6	1.6 — 2.8
IV	74.5	0.5	71.7	0.7	2.8	0.7	2.1 — 3.5
Room C							
I	74.6	0.6	73.0	0.3	1.6	0.6	1.0 — 2.2
II	76.0	0.8	74.0	0.4	2.0	0.8	1.2 — 2.8
III	75.5	1.5	70.9	0.5	2.6	1.4	1.2 — 4.0
IV	74.6	1.0	72.1	0.6	2.5	1.2	1.3 — 3.7
V	75.0	2.0	70.6	0.6	4.4	2.1	2.3 — 6.5
Room D							
III	74.3	1.2	71.0	0.5	3.3	1.3	2.0 — 4.6
IV	75.8	0.9	72.3	0.5	3.5	1.3	2.2 — 4.8
V	75.4	2.8	69.4	0.5	6.0	2.7	3.3 — 8.7

*Col. 6 ± Col. 7.

Operating Conditions:

Case I — Jan. 25-Feb. 10, 1952, Room C — Bare Panel.

Case II — Mar. 1-30, 1952, Room C — Bare Panel.

Case III — Dec. 2-31, 1952, Room A — Rubber Tile; Room B — Asphalt Tile; Room C — Heavy Carpet and Pad; Room D — Light Carpet and Rubber Pad.

Case IV — Jan. 5-26, 1953, Room A — Rubber Tile; Room B — Asphalt Tile; Room C — Heavy Carpet and Pad; Room D — Light Carpet and Rubber Pad.

Case V — Feb. 27-Mar. 29, 1953, Room C — Light Carpet and ½ oz. Pad; Room D — Heavy Carpet and Rubber Pad.

and D due to the comparatively rapid response of the system.

These curves show the effects of the carpet and pad combinations on the control of the room-air temperature. Part of the difference in the control characteristics of Rooms A, C and D might be attributed to the differences in exposure. However, additional panel capacity was provided in design to offset this portion of the difference. Observations in Rooms A, C and D as reported in Table 2 verify the conclusion that the additional exposure had a negligible effect on the control as compared to the effect of the carpet and pad combinations.

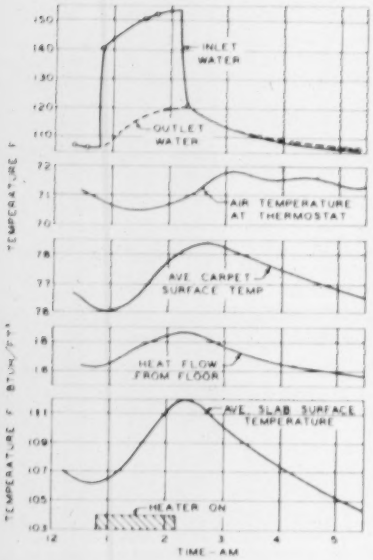

Fig. 4—Special study over one heater coil in Room C, made for January 10, 1953 with average outdoor temperature of 33 F

Since, during the study previously discussed, there was an extremely long heater operating period for Room C due to the rapid decrease in outdoor temperature, the overrun in room-air temperature was exaggerated. Therefore, a typical day was chosen to make a study over one complete heater cycle in Room C. The outdoor temperature during this study was relatively constant at about 33 F. Temperatures of slab surface, carpet surface, room-air and water were measured during this test along with heat flow from the slab to the carpet. The floor covering consisted of the heavy weight carpet and 40 oz pad. Fig. 4 shows a plot of the measured temperatures and heat flows *vs.* time.

This test indicates that there was a relatively long period between the times when the thermostat called for heat and when the air temperature started to increase. The effect of the carpet and pad was to retard the flow of heat from the water to the room air and cause about 0.3 deg under and a 1.0 deg overrun in room-air temperature. After the thermostat called for heat it was satisfied 1 hr 20 min. Thus, the response time for the heating system was very long.

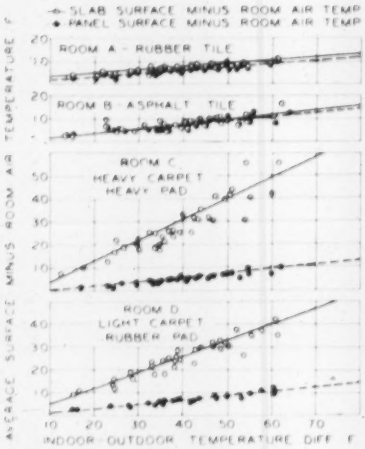
SLAB SURFACE MINUS ROOM AIR TEMP
PANEL SURFACE MINUS ROOM AIR TEMP
ROOM A - RUBBER TILE
ROOM B - ASPHALT TILE
ROOM C HEAVY CARPET HEAVY PAD
ROOM D LIGHT CARPET RUBBER PAD
AVERAGE SURFACE MINUS ROOM AIR TEMPERATURE F
INDOOR-OUTDOOR TEMPERATURE DIFF F

Fig. 5—Panel and slab surface minus room-air temperatures

Room Surface Temperatures

Floor Covering and Slab Surface Temperatures: Floor surface temperatures were obtained by thermocouples installed on the surface of the floor coverings, while the slab surface temperatures were obtained from thermocouples located on the slab surface. Fig. 5 shows a plot of floor covering surface (panel surface) minus room-air temperature difference *vs.* indoor-outdoor temperature difference. Also plotted in the same figure are the slab surface minus room-air temperature differences.

The equivalent thermal resistance of the floor covering in each room is given by Equation 2 in Part I[2] of this paper. The value of Q/A at design conditions for each room was obtained by multiplying the percent above floor heat flow from Fig. 7, Part I, by the total heat flow from the panel in Fig. 6, Part I, at 80 F indoor-outdoor temperature difference, and dividing by the panel area.

Since for Room C the upward heat flow chosen from Part I of this paper included that for the inactive panel area while the temperature difference across the floor covering was evaluated for only the active panel area, the heat flow (taken from Fig. 6, Part I) had to be corrected to include the active panel only. Recorded data indicate that the total upward heat flow should be reduced by about 5 percent to correct for the inactive panel area. Therefore, the equivalent thermal resistance of the floor covering in Room C was

$$54.0/(0.95)(36.8) = 1.55$$

while that in Room D was

$$38.0/40.5 = 0.94 \text{ hr (sq ft)(F) per Btu}$$

The thermal resistances of these carpet and pad combinations in Rooms C and D were 1.85 and 0.99 hr (sq

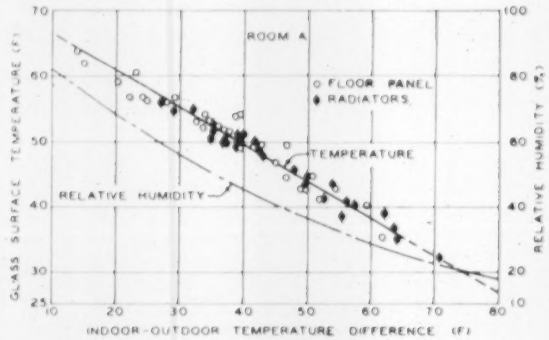

Fig. 6—Inside window surface temperature and allowable station humidity indoors

ft) (F) per Btu, respectively, as determined in the standard guarded hot plate by the method described in Part I. The 2 thermal resistances determined by these different methods were within 5 percent in Room D, while those in Room C differed by about 16 percent. The differences in thermal resistances of the floor cover-

Table 3—Room Surface Temperatures, Fahrenheit Degrees

	Room A		Room C	
Outdoor Temp	35.0	12.5	35.0	12.5
Surface Temp				
East Wall[a]				
24 in.	71.4	72.0	75.5	75.4
72 in.	70.3	70.5	70.5	70.0
West Wall[a]				
24 in.	70.5	70.1	70.9	71.2
72 in.	70.2	69.4	70.1	69.9
South Wall[a]				
24 in.	70.3	69.4	70.6	70.5
72 in.	70.4	69.7	70.3	69.7
North Wall[a]				
24 in.	67.7	65.4	66.8	65.5
72 in.	67.3	64.8	67.8	65.9
89 in.	—	—	68.6	67.8
N. Window[a]				
42 in.	52.0	39.7	51.2	37.4
54 in.	52.5	39.6	50.9	36.1
Floor[b]				
6 in.	77.4	82.1	75.1	75.9
12 in.	74.5	75.8	75.5	78.4
18 in.	76.5	80.1	74.5	77.7
24 in.	75.0	76.1	74.9	78.4
30 in.	77.0	79.6	75.4	78.6
36 in.	76.0	77.8	75.5	78.5
42 in.	77.8	80.9	75.4	79.0
54 in.	76.5	78.5	76.0	79.4
78 in.	77.5	80.2	75.6	78.7
96 in.	75.2	74.0	75.7	79.6
114 in.	69.8	69.0	76.0	79.4
132 in.	69.3	68.4	72.2	73.0
Ceiling[b]				
5 in.	67.6	64.5	—	—
12 in.	68.5	66.5	—	—
21 in.	68.5	67.1	—	—
30 in.	68.5	67.8	69.6	69.2
39 in.	68.9	68.4	—	—
48 in.	69.7	69.1	—	—
54 in.	69.7	69.5	—	—
65 in.	70.2	69.6	—	—
72 in.	70.2	69.5	—	—
87 in.	70.1	69.5	—	—
102 in.	69.8	69.1	70.3	70.7
120 in.	69.6	68.7	—	—

[a]Inches measured above floor.
[b]On N-S center line of room; figures are inches from North Wall, each case.

ings as determined by the 2 methods could be due to uncontrollable variables. The method of surface temperature determination in the 2 tests was different. Under actual operating conditions the heat flow from the slab to the room was not steady, and there was probably considerable heat storage within the carpet and pad. The moisture content of the floor coverings could have influenced the results to the extent that the thermal resistance would change and heat would be required to evaporate any moisture present in the covering. No attempt was made to evaluate the moisture content of the floor covering for any test. Furthermore, the samples used for hot plate tests were not necessarily representative of the actual coverings used since variations in materials and manufacturing techniques could result in differences in physical properties.

Glass Surface Temperatures: Thermocouples installed on the inside surfaces of the windows in the test rooms provided a means of determining the glass surface temperatures. Fig. 6 shows a plot of the inside window surface temperature for Room A *vs.* indoor-outdoor temperature difference. This curve was identical with those obtained for all other test rooms. Also indicated are the test points obtained in the *I—B—R* Research Home[3] with a conventional hot water heating system using small tube radiators. The same curve was drawn through all the points indicating that there was no difference in the observed window surface temperatures in the 2 cases.

The dotted curve in Fig. 6 represents the relative humidity of 72 F air which will result in a dew-point temperature equal to the measured surface temperature of single glazed windows.

Wall, Floor and Ceiling Surface Temperatures: Surface temperatures of the walls, floors and ceilings were obtained by thermocouples. For the unexposed walls in all rooms and the ceilings in Rooms C and D the average reading of all the thermocouples on one surface represented the area weighted average temperature of that surface.

To show the distribution of surface temperature in the test rooms, 2 days were selected; one when the outdoor temperature was about 12 F, and the other for an outdoor temperature of about 35 F. Table 3 shows the surface temperatures for various elements of Rooms A and C and these 2 days.

Table 3 shows that at 24 in. above the floor in both Rooms A and C the east wall surface temperatures were greater than the west. This was due to the presence of the supply piping in the east walls of these rooms. The table also shows that the temperature of the lower half of the east wall was greater in Room C than in Room A because of the increased water temperature in the supply piping in Room C. In both rooms the temperature of the lower half of all the partitions was greater than that of the upper half, probably the result of conduction and radiation from the heated slab to the partitions.

Journal Section

Table 4 shows the relationship between room-air temperature minus surface temperature and indoor-outdoor temperature difference for all 4 test rooms. Average surface temperatures were subtracted from the room-air temperature for all read-

Table 4—Room Air Temperature *T* Minus NWST, AUST, and AST[a]

Indoor-Outdoor Temp Diff F	Room A with Rubber Tile		
	T_a minus NWST	T_a minus AUST	T_a minus AST
20	2.0 ± 0.3	1.0 ± 0.2	0.5 ± 0.2
40	4.0 ± 0.2	1.9 ± 0.1	0.8 ± 0.1
60	5.9 ± 0.4	2.8 ± 0.3	1.0 ± 0.3
80	7.9 ± 0.7	3.7 ± 0.5	1.3 ± 0.5
Indoor-Outdoor Temp Diff F	Room B with Asphalt Tile		
	T_a minus NWST	T_a minus AUST	T_a minus AST
20	2.1 ± 0.4	1.0 ± 0.3	0.5 ± 0.3
40	4.1 ± 0.2	1.9 ± 0.2	0.7 ± 0.1
60	6.0 ± 0.4	2.8 ± 0.3	1.0 ± 0.3
80	8.1 ± 0.7	3.8 ± 0.6	1.3 ± 0.5
Indoor-Outdoor Temp Diff F	Room C with Heavy Carpet and Heavy Pad		
	T_a minus NWST	T_a minus AUST	T_a minus AST
20	2.2 ± 0.4	1.0 ± 0.1	0.5 ± 0.3
40	4.1 ± 0.2	1.6 ± 0.1	0.2 ± 0.2
60	5.9 ± 0.5	2.3 ± 0.1	0.0 ± 0.4
80	7.8 ± 0.8	3.0 ± 0.3	−0.5 ± 0.6
Indoor-Outdoor Temp Diff F	Room D with Light Carpet and Light Pad		
	T_a minus NWST	T_a minus AUST	T_a minus AST
20	1.9 ± 0.2	0.9 ± 0.4	0.1 ± 0.3
40	3.8 ± 0.2	2.0 ± 0.2	0.1 ± 0.1
60	5.6 ± 0.3	3.0 ± 0.4	0.2 ± 0.3
80	7.4 ± 0.6	4.1 ± 0.7	0.2 ± 0.5

[a]Air temperatures measured at 30-in. level at center of room. Figures in table are for confidence limit of 95 percent (Average Values).

ings to eliminate the effects of fluctuations in room-air temperature.

The difference between the air temperature and the AUST*, the average surface temperature (AST) and the average north wall surface temperature (NWST) are all shown in Table 4. The NWST does not include the window surface temperature. Since there was an additional window in Room C as compared to Rooms A and B, one would expect a lower AUST for the same room-air temperature. However, the effect of the carpet and pad was to warm the lower portions of the walls adjacent to the panel. Also, the supply piping was located within the partitions separating Room A from Room B and Room C from Room D. The higher water temperature required in Rooms C and D resulted in higher

*The AUST represents the area weighted average temperature of all the unheated surfaces of the room.

surface temperatures for the partitions between these 2 rooms. These caused an increase in the AUST which more than compensated for the additional window. The net effect was to cause a higher AUST than in Rooms A and B. In Room D the AUST was the same as in Rooms A and B, even though the exposure was much more severe. The effect of the carpeting and piping on the wall surface temperature in Room D affected the AUST by about the same amount as the additional window and exposed wall.

The AUST has been established as a parameter which determines the total heat transfer from a panel for a given panel surface temperature

Table 5—MRT, AST and AUST in Room A Floor Panel Heating*

Indoor Outdoor Temp Diff F	MRT at center of room	AST	AUST
20	70.5 ± 0.1	70.1 ± 0.4	70.2 ± 0.2
40	70.0 ± 0.1	69.9 ± 0.1	68.9 ± 0.1
60	69.4 ± 0.1	69.6 ± 0.4	67.5 ± 0.2
80	68.8 ± 0.5	69.5 ± 0.7	66.2 ± 0.4

*Figures in table are for confidence limit of 95 percent (average values).

and infiltration rate[4]. Relationships between AUST, panel surface temperature, infiltration, room-air temperature, and total panel heat output have been found at the ASHAE Laboratory. These relationships apply to rooms whose geometry is similar to that which would be encountered in practice.

Since calculation of the AUST does not include the heated panel area the net radiant heat exchange between a body located in the room and its surroundings would depend not only upon the AUST, but also upon the panel surface temperature. Furthermore, the location of the body with respect to the surrounding surfaces must be taken into consideration. *Body temperature depends upon the balance between heat production and heat loss.*[5] If a person were sitting at rest in the center of the test room his body temperature would be determined by the environmental factors of dry-bulb temperature, humidity, air motion, and surface temperature of the surroundings[6,7]. Upon moving away from the center of the test room toward the window, the net radiant heat exchange between the body and surrounding surfaces would change as a result of a change in configuration factor of the body with respect to the surrounding surfaces. The configuration factor of the body with respect to the exposed wall would increase while the configuration factor of the body with respect to the other room elements would decrease[8]. If the air

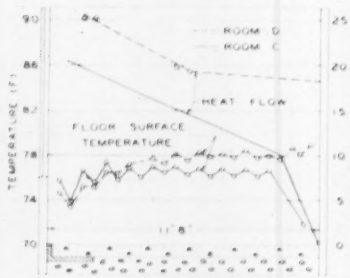

Fig. 7—Heat flow and surface temperature profiles in Rooms C and D. Data for December 3, 1953 with outdoor temperature of 29 F; room air temperature of 70.5 F (both rooms); AUST of Room C at 68.5 and AUST of Room D at 68.8 F

temperature, humidity, and motion were the same, near the window as at the center of the room, a lower body surface temperature would result in order that the total heat loss from the body would remain equal to the metabolic rate. The magnitude of this change in body surface temperature would depend upon the change in net radiant heat transfer from the body. This is also affected largely by the type of clothing worn.

However, the important fact here is that a change in the net radiant heat transfer from the body would result, and, therefore, one constant such as the AUST or AST could not represent the MRT (mean radiant temperature) which is an index of the amount of radiation taking place between the body and its environment, referred to a uniform environment. The MRT is a function of location of the body within the test room.

In Rooms A and B the AST was about 1 F below the room-air temperature while in Rooms C and D the AST was essentially the same as the room-air temperature. These data show that even though Rooms C and D had more severe exposures, the AST was slightly higher for a given room-air temperature than in Rooms A and B. This was due to increased panel area and higher temperature of the lower partition surfaces because of the presence of the supply piping and carpeting.

Several instruments have been employed for the measurement of MRT in an environment[7], including the eupathescope, the globe thermometer, and the thermo-integrator. (See† Appendix A†). During these tests MRT was measured by a thermo-integrator installed in Room A at the center of the room with the center of the instrument approximately 30 in. above the floor. Table 5 shows the relationship of the AST to the indoor-outdoor temperature difference for Room A. The AST and MRT decreased slightly with increasing indoor-outdoor temperature difference

Table 6—Calculated vs. Measured Heat Flow to Rooms*

Calculated Heat Flow to Room, Btuh	Average Measured Heat Flow to Room, Btuh	
	Room A	Room B
3000	4010 ± 61	4225 ± 84
2000	2985 ± 62	2220 ± 84
5000	5160 ± 141	5270 ± 166
4000	4250 ± 250	4215 ± 262
5000	5305 ± 320	5240 ± 360
	Room C	Room D
3000	3225 ± 125	3510 ± 222
2000	2585 ± 81	2570 ± 135
5000	5547 ± 149	5450 ± 116
4000	4765 ± 250	4490 ± 186
5000	5870 ± 357	5550 ± 286

*Figures in table are for confidence limit of 95 percent.

while the AUST dropped off rapidly. It is evident from Table 5 that the AST closely approximates the MRT obtained at the center of Room A, 30 in. above the floor. It should be pointed out that such may not be the case for other locations.

Since the AST approximated the MRT at the center of the room, the data of Table 4 suggest that a lower room-air temperature might be tolerated in Rooms C and D than in Rooms A and B because of higher AST's for a given outdoor temperature.

Heat Flow and Floor Surface Temperature Profiles

The heat flow and floor surface temperature profiles for bare floor panels have been reported in a previous paper[1]. Installation of tile over the panels in Rooms A and B had no significant effect on these characteristics.

Fig. 7 shows a plot of floor surface temperature and heat flow pro-

†It is planned to publish the Appendix with this paper in TRANSACTIONS.

files in Rooms C and D with carpets and pads installed over the panels. For these tests the average carpet surface temperature increased toward the center of the room, but the heat flow from the panel to the carpeting was greatest near the exposed wall and decreased toward the center of the room.

In general, the effects of the carpeting were to cause an increase in the floor surface temperature along a line toward the center of the room and to smooth out the heat flow profile from the panel to the carpet. The carpeting also caused some increase in the subfloor heat flow over that obtained for bare panels. The effect of the carpeting on the below floor heat losses was discussed in Part I of this paper.

Calculated and Measured Panel Heat Output

The total heat output from the panel to the test rooms is equal to the sum of the radiation and convection components. The heat transferred from the panel by convection and radiation was calculated using the equations presented in THE GUIDE 1955, pp. 569-571. The convection portion of the total heat transfer from the panel is given by[9]

$$q_c = 0.81\ (t_s - t_a)^{1.32} \quad \ldots\ldots\ldots (1)$$

and the radiation is given by[10]

$$q_r = 0.142\ [(T_s/100)^4 - (T_w/100)^4] \quad \ldots\ldots\ldots (2)$$

and

$$q_t = q_c + q_r$$

where

q_c = heat transfer by convection in Btu per (hour) (square foot).

q_r = heat transfer by radiation in Btu per (hour) (square foot).

q_t = heat transfer, total, in Btu per (hour) (square foot).

t_s = panel surface temperature in Fahrenheit degrees.

t_a = air temperature in Fahrenheit degrees.

T_s = panel surface temperature in Fahrenheit (absolute).

T_w = average unheated surface temperature of the surrounding surfaces in Fahrenheit (absolute).

The air temperature used in these calculations was measured at a distance of 3 in. above the floor at 2 locations — 2 ft from the north wall and at the center of the room. The air temperatures at these locations depended on outdoor temperature and differed from one another 2 to 4 F. The AUST was used for the temperature of the surroundings as recommended in THE GUIDE. Table 6 shows the relationship between the measured and calculated panel outputs for all test rooms. In all cases, the measured panel output was consistently higher than the calculated panel output. At design conditions of 80 F indoor-outdoor temperature difference, the percent difference between the calculated and measured panel output was from 7 to 18 percent (based on the measured output). The percent difference was greater for the rooms with more severe exposures.

Table 7—Average Panel Heat Output to Rooms*

Panel Surface Temp. Minus Room Air Temp., F	Panel Output to Room, Btuh per sq ft	
	Room A	Room B
2	4.2 ± 1.2	5.2 ± 0.9
4	9.5 ± 0.7	10.2 ± 0.6
6	14.7 ± 0.5	15.3 ± 0.5
8	19.9 ± 0.9	20.5 ± 0.6
10	25.1 ± 1.5	25.3 ± 0.9
12	30.4 ± 1.7	29.5 ± 1.5
14	35.6 ± 2.8	33.4 ± 1.6
	Room C	Room D
2	7.1 ± 0.8	6.1 ± 1.3
4	12.5 ± 0.6	11.3 ± 0.9
6	17.8 ± 0.5	16.4 ± 0.6
8	23.2 ± 0.8	21.6 ± 0.7
10	28.6 ± 1.2	26.7 ± 1.0
12	34.0 ± 1.5	31.9 ± 1.4
14	39.3 ± 2.0	37.0 ± 1.9

*Figures in table are for confidence limit of 95 percent.

Table 8—Average Relative Humidity in Test Rooms*

Indoor-Outdoor Temp. Diff. F	Measured Relative Humidity in Percent		
	Room B with Asphalt Tile	Room D with Light Carpet and Rubber Pad Test I	Room D With Heavy Carpet and Rubber Pad Test II
20	52.5 ± 6.5	54.4 ± 2.2	55.9 ± 2.3
40	25.7 ± 2.3	30.6 ± 0.8	30.8 ± 1.2
60	15.1 ± 6.8	26.9 ± 2.0	29.8 ± 3.2
80	6.5 ± 12.7	25.1 ± 3.8	29.5 ± 5.1

*Figures in table are for confidence limit of 95 percent.

The calculated convection heat transfer from the panel was based on the equation expressing the heat flow from a horizontal flat plate facing upward with no unusual end effects[9]. The presence of the exposed wall in the test rooms caused a downward cold air current which passed over the surface of the panel as indicated in Fig. 2. This increased air velocity over the surface of the panel probably resulted in a greater heat flow from the panel by convection for a given surface to air temperature difference than that calculated by Equation 1. This could account for part of the difference in the calculated and measured panel output. Also, the panel surface temperatures measured in Rooms C and D may not have been accurate because of the difficulty in establishing the actual surface of the carpeting. The heat flow as determined by heat flow meters in Rooms C and D was actually the heat flow from the slab to the carpet and pad. Since there was some heat storage in the floor coverings, the heat flow from carpet to room at any instant was not necessarily the same as that measured by the heat flow meters. This may have been a factor influencing the difference in the measured and calculated panel outputs.

The relationship between panel output and panel minus room-air temperature is shown in Table 7. In rooms A and B for which the exposures were similar, the panel outputs for a given panel minus room-air temperature difference were approximately the same. The outputs for Rooms C and D where the exposures were more severe were 15 to 20 percent greater than in Rooms A and B at the same panel minus room-air temperature difference. The same panel minus room-air temperature difference in all rooms does not represent the same outdoor conditions since the variation in panel surface minus room-air temperature with outdoor temperature was not the same in all test rooms (see Fig. 5). Variations in panel output were due to variations in exposure, infiltration, and panel area.

At design conditions the panel output for Room A was about 30.4 Btuh per sq ft while the output of the panel in Room B was about 35.4 Btuh per sq ft — a difference of about 5.0 Btuh per sq ft. These panel outputs may be obtained from Table 7 using panel surface minus room-air temperature corresponding to design conditions as obtained from Fig. 5. Based on the panel area, the difference in panel outputs represents about (116 × 5.0) or 580 Btuh. Calculations indicate that a difference of 0.3 air changes per hr could account for this difference in panel output, but no measure of the infiltration rate was made during these studies.

Data have been presented[4] which correlated AUST, panel output, panel surface temperature and infiltration. However, no comparison of results could be made because no attempt was made to control the air temperature in the ASHAE experiments. Because the air temperature was the independent variable in those experiments, the room-air temperatures were all lower for a given test as compared to those reported in this paper. As a result, the panel outputs reported here are greater for a given panel surface temperature and AUST than for those reported in the ASHAE results.

Relative Humidity

The relative humidity in each test room was obtained with calibrated hair-type relative humidity indicators. Table 8 shows the relationship between relative humidity and indoor-outdoor temperature difference. A comparison of the relative humidity in Rooms B and D for Test I indicates that during mild weather (20 F indoor-outdoor temperature difference) the relative humidity was about the same for both rooms. However, as the indoor-outdoor temperature difference increased, the relative humidity in Room B decreased more rapidly than in Room D. The relative humidity in Room D for Test II was higher than for either room during Test I. Also, there appeared to be more scattering of test points.

Observation showed that the relative humidity in Room D was consistently greater than that in Room B. This was thought to show that water vapor was flowing into Room D because of an increased rate of water vapor transfer through the floor slab in the carpeted room.

In order to judge the validity of this thinking, a mass balance was established on the water vapor in Rooms B and D and the resulting relative humidities in the test rooms were calculated for various outdoor temperatures.

The method of calculating this balance, the equations used, and plots of the results are included in Appendix B. There, too, a comparison is made indicating that results from the calculations were in good agreement with the values shown by the relative humidity measurements. It is planned to publish Appendix B, with the paper in TRANSACTIONS.

Conclusions

1. At design conditions of 80 F indoor-outdoor temperature difference the maximum difference in room-air temperature between the levels 3 in. above the floor and 3 in. below the ceiling was 3.5 F. At a location 2 ft from the north wall, the room-air temperature was 3 F lower than at the center of the room. Cooled air dropped to the floor at the north wall and window and moved in the direction of the south wall with a somewhat high velocity.

2. Addition of floor coverings to bare floor panels reduced the ability of the system to maintain a constant room-air temperature. The greater the thermal resistance of the floor covering, the greater the resulting room-air temperature variation. Carpets and pads retarded the flow of heat from the water to the room-air, resulting in poor response.

3. Glass surface temperatures measured with floor panel heating were the same as those obtained in the Research Home with conventional radiation.

4. The exposed wall surface temperature was about 8 F lower and the AUST was about 4 F lower than the room-air temperature measured at the center of the room 30 in. above the floor.

5. The AST in Rooms A and B was about 1 F below the room-air temperature while in Rooms C and D the AST was essentially the same as the room-air temperature.

6. The MRT as obtained in the center of Room A with a thermo-integrator was the same as the AST for all outdoor conditions encountered.

7. The effects of the carpeting were to cause an increase in the floor surface temperature along a line toward the center of the room and to smooth out the heat flow profile from the panel to the carpet.

8. At design conditions of 80 F indoor-outdoor temperature difference the measured panel output was from 7 to 18 percent greater than the calculated panel output. For a given panel minus room-air temperature difference the panel heat output to Rooms C and D, which had more severe exposures, were 15 to 20 percent greater than outputs in Rooms A and B.

9. The relative humidity in Room D which had a carpet and pad was consistently greater than that in Room B, indicating that there was probably an increase in the rate of transfer of water vapor through the concrete floor slab in this room. Trend curves obtained from calculations based upon a mass balance for the water vapor were in agreement with those obtained from measurements of relative humidity.

Acknowledgments

This report concerns one phase of the panel heating research project which is part of the comprehensive steam and hot water heating investigation being conducted by the *Institute of Boiler and Radiator Manufacturers* in cooperation with the University of Illinois. Eventually the results of this research project will be compiled in an Engineering Experiment Station Bulletin.

The authors wish to acknowledge especially the assistance of research assistants Albert J. Wiegand and Liang-Neng Tao in obtaining and compiling data for this report. Also, acknowledgment is made of companies which contributed equipment for this study.

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The Dust Spot Method for Evaluating Air Cleaners

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This paper is the result of research sponsored by the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, in cooperation with the Mechanical Engineering Department, University of Minnesota, Minneapolis, Minn.

SUMMARY—A study of the dust spot method has shown that such factors as type of filter media used, optical design of the photometer and nature of the dust sampled have an important bearing on the meaning of the data obtained. For accurate work, glass fiber and millipore filters have been found to be superior to the chemical papers ordinarily used. An improved photometer incorporating the findings of this study is also described.

TESTING of air cleaners for effectiveness requires the sampling and evaluation of the airborne dust concentration before and after the air cleaner. This may be accomplished in a number of ways, the meaning of the resulting efficiency number depending on the dust property evaluated. The 3 most common methods of sample evaluation are by counting the number of particles, by comparison of the optical quality of samples collected on suitable media and by weighing.

Each of these has its sphere of usefulness. If the test dust is homogeneous with respect to particle size, then all 3 methods will yield equivalent efficiency values, but if the dust has a relatively broad distribution, as is usually the case, then the 3 evaluations will be quite different. For example, a conventional permanent type viscous filter that was investigated had an efficiency on normal air-borne dust of 53 percent by weight, 14 percent by dust spot and 0.4 percent by number.

Optical Methods

A number of different optical methods for evaluating air cleaners have been developed. Perhaps the best known of these is the so-called dust spot method developed by the Bureau of Standards[1]. In this method, the dust laden air is drawn through a filter paper medium and the resulting spot is evaluated by visual comparison or by photometric measurement of the light transmitted or reflected by the paper.

During and after World War II, several instruments capable of measuring the light scattered from the air-borne particles in situ were developed under government sponsorship. In the penetrometer type instrument[2], an intense light beam is passed through the dusty air and the light scattered from the dust particles is measured by a sensitive photo tube. The relative amount of light scattered before and after the cleaner is an index of the air cleaner efficiency. These instruments have been used extensively in combination with homogeneous aerosol generators for the evaluation of high efficiency air cleaners.

Another type[3, 4] counts and measures the magnitude of the light flashes as each particle passes through the light beam. With this instrument, an estimate of the size distribution may be obtained in addition to the concentration. However, these counters are very costly.

The Dust Spot Method

Previous Work: Because of its simplicity and convenience, the dust spot method has been widely used. A variety of filter media and measuring techniques have been used. Among the better known are variations of the method developed by Dill at the National Bureau of Standards[1]. In this method the upstream and downstream samples of dust collected on chemical filter paper are evaluated in a simple photometer. To eliminate the need for an accurate knowledge of the relationship between optical density and dust concentration, the air-flow rate and sampling time is adjusted so that the 2 samples have approximately the same optical density.

A later instrument used with the Dill dust spot method combines the filter paper holders and photometer into a single unit for convenience and portability. Here the 2 filter papers and photocells are placed on opposite sides of a lamp, and so connected to a galvanometer that an unequal rate of decrease of the light transmission of the 2 filters is indicated by the galvanometer deflection. The relative air flow through the 2 filters at balance is a measure of filter efficiency.

Most of the dust spot methods have used the reduction in light transmission of a translucent filter as a measure of the dust deposit. Studies by Rowley and Jordan[5] have shown that the reflected light is not as reliable a measure of the dust deposit as is the transmitted light.

Present Research at the University of Minnesota: As part of the research on air cleaning, a preliminary study of the dust spot method was made. This study showed that such factors as optical design of the photometer and filter media used could have a considerable bearing on the resulting measurements. Accordingly, research was initiated to further study the relative performance of available filter media and to develop an optimum photometer design. At the

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[1]Exponent numerals refer to References.

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same time, a study was made to discover exactly what dust properties were being measured.

Theory: Because theoretical basis for the dust spot method has been discussed in detail elsewhere[5, 6, 7], only a brief outline is given here.

Nomenclature

A = filter area
c = dust loading per unit filter area
q = sampling rate
t = sampling time
OD = optical density
I_o = light transmission of clean filter
I = light transmission of dirty filter
k = constant
p = pressure drop across filter media, $p = p_o V^n$
p_o = resistance coefficient, in centimeters of mercury
V = filter face velocity, in feet per minute
n = a constant
k = light scattering coefficient
η = filter arrestance or efficiency
α = semi-angle of acceptance of measuring photocell
u = subscript referring to upstream
d = subscript referring to downstream

The basic equation for calculating the efficiency of an air cleaner from upstream and downstream samples is given by:

$$\eta = 1 - [(C_d/C_u)(q_d/q_u)(t_d/t_u)(A_u/A_d)] \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

The dust spot method may be used with Equation 1 to evaluate air cleaners in several ways. If the exact relationship between C and the reduction in light transmission due to the dust spot is not known, the other variables may be selected so that the optical quality of the upstream and downstream samples are equal and $C_d = C_u$. Though this procedure eliminates the need for knowing the OD* C relationship, it has disadvantages.

The ratio A_u / A_d is usually fixed by the sampler design, often at a 1 to 1 ratio. Also the practical limitations of flowmeters in combination with the pressure drop characteristics of high efficiency sampling media usually make it impractical to obtain more than a 1 to 10 ratio of upstream to downstream air-flow rates. The use of variable sampling times requires that the dust feed rate or dust concentration to the air cleaner be constant. However, the greatest disadvantage stems from the additional effort involved in adjusting sampling areas, air flows or sampling times to obtain equal optical densities upstream and downstream while still maintaining isokinetic flow through the sampler heads.

For these reasons it appeared desirable to study the OD-C relationship to discover the magnitude of the deviation from the Lambert-Beer law and to define the possible conditions under which variable OD might be used in air cleaner testing.

Sampling Media

Because of their relatively high light transmission, strength and availability chemical filter papers have been most frequently used as dust spot sampling media. Within recent years higher efficiency glass fiber papers and millipore filters have become available. In view of certain known deficiencies of the chemical papers, a study of all 3 was made to determine the properties of each.

Important properties are given in Table 1. The pressure drop coefficients given are valid up to a face velocity of about 150 fpm. Above 150 fpm, n slowly increases. The dust spot arrestance of the W-41 paper was measured at a face velocity of 40 fpm using a millipore filter downstream of the paper. A series of such measurements under different weather conditions in the University of Minnesota Particle Laboratory on different samples of paper gave arrestance values from 43 to 95 percent with the average being about 88 percent. The 43 percent arrestance was obtained on a rainy day.

From Table 1 it can be seen that the 2 most serious deficiencies of the chemical papers are low efficiency on atmospheric dust and poorer obedience of the Lambert-Beer law. However, the glass fiber and millipore filters have higher pressure drops, are more fragile, and require sensitive photometers because of their lower light transmission.

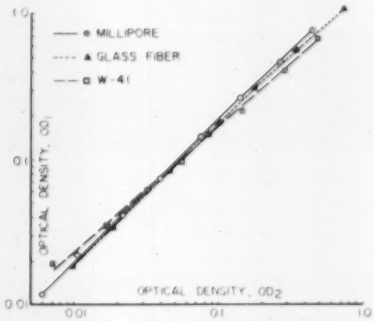


Fig. 1 — Deviations from Lambert-Beer Law for 3 sampling media

Optical Density Concentration Relationship

Because of its general application in the field of colorimetry, the Lambert-Beer law has generally been used to derive the OD-C relationship[6, 7, 8]. In the usual form it is given by:

$$OD = \log (I_o/I) = kC \quad \ldots\ldots\ldots\ldots (2)$$

Davies and Aylward[5] and Hemeon[6] have confirmed the approximate

Table 1—Properties of Sampling Media

Property		Chemical filter paper W-41	Glass filter paper	AA Millipore
1 Strength		Good	Fair—Requires Support	Fragile—Requires Support
2 Light transmission, in % ($OD = 2.0$)		5.2	1.2	0.8
3 Flow — p_o		0.033	0.045	0.24
Coefficients* — n		1.05	1.04	0.82
4 Lambert-Beer Law		Fair	Good	Good
5 Dust spot arrestance on atmospheric dust		50-95%	99+	100%
6 Uniformity		Fair	Subject to pinholes	Good
7 OD	Atmospheric dust	1.2-1.5	1.2	1.0
OD (millipore)	Carbon Dust	1.2	1.0	1.0
8 Suitability for weighing of dust on filter		Fair	Excellent	Fair
9 Suitability for microscope of Sedimentation size analysis		No	No	Good

*Flow Coefficients: $p = p_o V^n$, with V in ft/min; and p_o in cm of Hg.

*Throughout the paper OD is used to represent optical density.

validity of Equation 2. However, more detailed investigations have shown that k is not exactly constant with C.

The decrease in k with increasing C may be evaluated directly by sampling a dust cloud of constant and known concentration[5] or by sampling simultaneously at varying rates from an unknown dust cloud. The possible influence of varying velocities through the filter medium in the latter procedure can be eliminated by using dilution with clean air to obtain different concentrations at a constant face velocity.

Because of the experimental difficulties a simpler method was devised to evaluate the relative linearity of the OD-C relationship for the different filter media.

Air-borne dust was sampled through 2 identical samplers at different rates. Periodically the 2 pieces of filter papers were removed and the optical density measured. For a given ratio of sampling rates through the 2 samplers, the change in the ratio of the optical densities of the filters as they load is an indication of the deviations from the Lambert-Beer law and also an indication of the error to be expected when the OD ratio is used as a measure of the C ratio in Equation 1. A convenient method of analyzing these data is to plot them on log-log paper as in Fig. 1. For such a plot

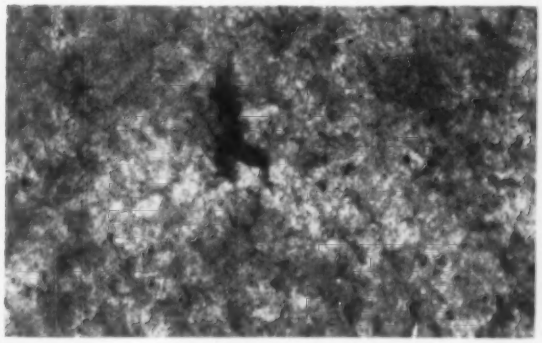
$$OD_1 = a\,OD_2^{\,b} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

where

a = the value of OD_1 at $OD_2 = 1$.
b = the slope.

If the Lambert-Beer law is obeyed exactly, the slope, b, is equal to 1. For a given air-flow ratio between filters 1 and 2; $1-b$ may be used as an index of the deviation from the Lambert-Beer law.

Results of the authors' experiments and some similar data from Engebretson[6] and Davies and Aylward[5] are given in Table 2. From Fig. 1 it will be noted that the slope of the plot changes at an OD_1 of approximately 0.3 for the millipore and glass fiber papers. Therefore $1-b$ in Table 2 is tabulated separately from the OD_1 ranges 0.03 to 0.3 and 0.3 to 1. The carbon dust is a semi-precipitated activated carbon ground to a very fine particle size. It was dispersed with a conventional aspirator type feeder into a 12-in. square filter test duct. Isokinetic sampling was used.



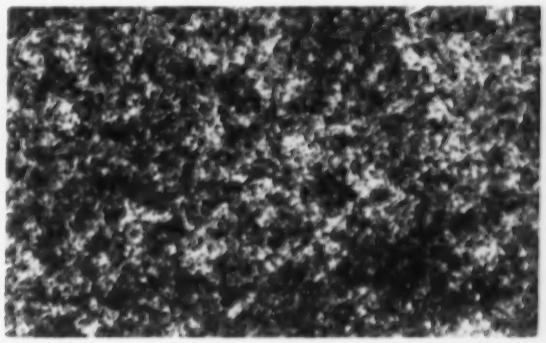


Fig. 2 — Variation in OD over small areas. Magnification 3.6 x (*left*) loaded glass fiber paper, and (*right*) loaded W-41 paper

Table 2—Optical Data on Filter Media

Source of data	Dust	Media	Air flow ratio	$1-b$: $OD_1 = 0.03$ to 0.3	$1-b$: $OD_1 = 0.3$ to 1	OD/OD_1: $OD_1 = 0.1$	OD/OD_1: $OD_1 = 0.3$	OD/OD_1: $OD_1 = 1.0$
Davies and Aylward[5]	Coal	Chemical Paper			0.14			
Engebretson[6]	Atmospheric	MF-MF	~2*	0.01	0.10	1.82	1.70	
Engebretson[6]	Atmospheric	W-41-MF	~2*	0.18	0.18	2.25	1.55	1.0
Present work	Atmospheric	GF-MF	1.85	0.005	0.09	2.26	2.28	
Present work	Atmospheric	MF-MF	1.93	0.005	0.06	1.98	1.93	
Present work	Atmospheric	GF-GF	1.93	0.01	0.11	1.88	1.82	
Present work	Atmospheric	W-41-W-41	1.90	0.15	0.15	2.32	1.72	
Present work	Carbon dust	MF-MF	1.79	0.03	0.03	2.15	2.02	
Present work	Carbon dust	GF-GF	1.86	0.01	0.01	1.75	1.71	
Present work	Carbon dust	W-41-W-41	1.91	0.06	0.06	2.0	1.61	
Theoretical log normal distribution of A_1 and A_2 ($\sigma_g = 2$)			2	0.055	0.10	2.00	1.80	1.60

*Approximately.

From Fig. 1 and Table 2 it can be seen that the glass fiber and millipore filters well obey the Lambert-Beer law up to an OD of about 0.3 for atmospheric dusts and to an OD of about 1 for the carbon dust. However, the W-41 paper obeys the Lambert-Beer law poorly even at low optical densities.

The different behavior of the media on the carbon and atmospheric dusts indicates that the decrease in k with increasing OD is connected with the distribution of dust in the filter. This conclusion is further supported by the data of Table 3. To obtain these

Table 3—Relative Optical Densities for a Given Amount of Dust

Media	Dust	OD media / OD MF	Collected from
GF	Carbon dust	1.00	Air
W-41	Carbon dust	1.14	Air
GF	Atmospheric	1.2	Air
W-41	Atmospheric	1.5	Air

data, equivalent amounts of dust were collected on the 3 media. It will be noted that the carbon dust which was observed not to penetrate very deeply into the glass fiber paper gave the same *OD* on millipore and glass fiber, but that the much finer atmospheric dust which somewhat penetrates the glass fiber paper gave a higher *OD*. Apparently the greater

Table 4—Approximate OD Ratio Correction Factor, *m*, for Millipore and Glass Fiber Media Filtering Atmospheric Dust (θ = 26 deg)

	OD_1/OD_2			
OD	1	2	4	∞
0.02	1	1	1	1
0.05	1	1.005	1.01	1.01
0.1	1	1.01	1.02	1.03
0.2	1	1.02	1.05	1.04
0.4	1	1.04	1.07	1.08
0.8	1	1.08	1.16	1.23

the depth of penetration, the greater the *OD* that results from a given amount of dust.

After the much greater non-linearity of the *OD-C* relation for the W-41 paper was discovered, the characteristics of the 3 media were studied carefully to find a possible explanation. It was then noted that the small scale distribution of dust in the W-41 paper was considerably more uneven than for the millipore or glass fiber. This is shown in Fig. 2. The negatives for these photographs were made by placing the filter media in a photographic enlarger, dirty side down, and projecting the resulting image on the film. Though the photographs are not faithful reproductions of the original degree of filter contrast the considerably poorer uniformity of the loaded W-41 paper (Fig. 2, right) is clearly visible.

Observations on a large number of dust spot samples indicate that the larger streaks and spots sometimes observed on loaded glass fiber or millipore filters have no appreciable effect if a substantial fraction of the dust spot is included in the illuminated area of the photometer.

Further insight into the reasons for the non-linearity of the *OD-C* relationship can be obtained if the Lambert-Beer law is modified to take into account the non-uniform buildup of *OD* on the different areas of the filter.

If the filter has n different areas building up *OD* at n different rates and it is assumed that each area obeys the Lambert-Beer law and has the same initial light transmission, then:

$$I_i = I_o e^{-k_i C} \qquad (4)$$

where

I_i = the intensity of the light transmitted by the i^{th} area A_i.
C = the concentration of dust per unit area of filter.
k_i = the rate of collection of the i^{th} area.
A_i = i^{th} area.
A = total area of filter.

Then the total amount of light through the filter is IA and

$$IA = \sum_{0}^{n} I_i A_i \qquad (5)$$

and

$$I = I_o \frac{\sum_{1}^{n} A_i e^{-k_i C}}{A} \qquad (6)$$

or

$$OD = \log_{10} \frac{\sum_{1}^{n} A_i e^{-k_i C}}{A} \qquad (7)$$

That a mechanism such as that just proposed can give rise to the characteristics observed in Fig. 1 and Table 2 is shown in Fig. 3. To calculate these curves, the approximate log-normal distribution of A_i/A and k_i given in the figure was used. Both the *OD* as a function of C and OD_1 *vs.* OD_2 for $C_1/C_2 = 2$ are plotted. Note that the calculated OD_1-OD_2 curve in Fig. 3 and Table 2 has a slope and curvature above $OD_1 = 0.3$ which is very similar to that observed in Fig. 1 for the glass fiber and millipore filters. Calculation of a number of such theoretical curves showed that all of the characteristics of the measured curves can be duplicated by proper choice of the distributions of k_i and A_i in Equation 7. From Figs. 1 and 3 and Tables 2 and 3 a number of conclusions may be drawn.

Table 5—Ratio of Measured to Calculated Optical Densities for a Number of Dusts (K = 1)

Measurement	θ	Dust			
		Arizona Fine	Coke Dust	NBS-Cottrell	Glass Beads
HAMF	24	0.098	1.35	0.54	0.091
GF	24	0.18	2.11	0.84	
Dunn Cell	3.3	0.57	1.89	0.62	

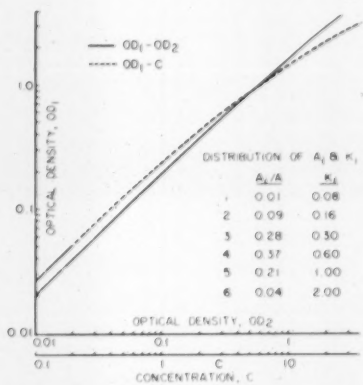


Fig. 3 — Theoretical OD-C and OD_1-OD_2 curve calculated from Equation 6

1. The non-linearity of the *OD-C* relationship appears to be due primarily to different rates of increase of optical density on different small scale areas of the filter.

2. The *OD-C* relationship is quite linear for glass fiber and millipore filters up to an *OD* of approximately 0.3 when sampling atmospheric dusts and up to *OD* = 1 for coarser dusts. The W-41 paper is non-linear on atmospheric dust at all optical densities and somewhat better on coarse dusts.

3. The depth of penetration determines the relative light hiding power of the dust. Millipore filters which retain the dust near the surface give lower optical densities than glass fiber or chemical papers. However the latter papers give lower optical densities when collecting coarser dusts which are retained near the surface.

4. If the ratio of downstream to upstream *OD* is used as a measure of the concentration ratio in Equation 1, a correction factor should be determined experimentally and used. Based on the data of Table 2 correction factors for glass fiber and millipore media have been calculated and tabulated in Table 4. The correction factor, m, is defined from Equation 8.

$$C_1/C_2 = m\,(OD_1/OD_2) \qquad (8)$$

m depends on the sampling media, the dust being sampled and the optical design of the photometer used.

Other Factors: In a previous paper[7] it was shown that from the measured size distributions of atmospheric dust, optical theory predicted the approximately correct *OD*. Since that time additional comparisons of the calculated and measured optical densities for a number of dusts have been made. Results are given in Table 5.

value. Thus the dust spot method is not sensitive to the transparent particles in the dust. The NBS-Cottrell dust which consists of a mixture of opaque and transparent particles shows behavior in between that of the opaque and transparent dusts.

Measurements in the cell were made as a check on the other measurements. Optical densities of particles suspended in a transparent medium are relatively independent of the opacity of the particles themselves when measured at low angles of acceptance. Therefore the ratio of measured to calculated *OD* is on the order of magnitude of 1 for all dusts.

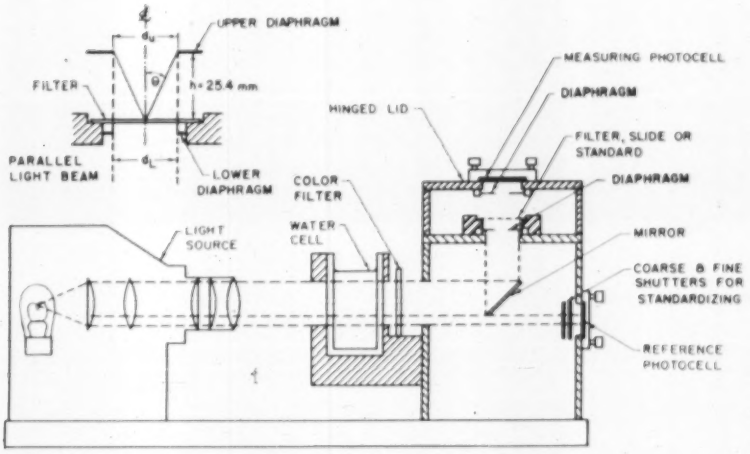


Fig. 4 — Optical design of photometer

Measured optical densities were obtained by filtering a known amount of a benzene suspension of the dust through the filter media and by measurement of a known concentration in a Dunn cell. Optical densities were calculated according to the procedures previously described[7] except that a light scattering coefficient $K = 1$ was used. As a result, the calculated values are a little low because K is usually between 1 and 2.

From Table 5, it is readily seen that the measured values of the *OD* for the transparent dusts, Arizona road dust, glass beads is only about 1/10 of the calculated value whereas the measured *OD* of the opaque coke dust is close to the calculated

Effect of Light Wave Length on Measured OD: To discover whether there might be any advantages in measuring the optical density at a particular wave length, the *OD* of several dusts deposited on millipore filters was measured using broad band gelatin filters. Results are given in Table 6.

Atmospheric samples 1 and 2 were taken during and just after a dust storm in which soil from the Dakotas was blown over Minneapolis. Sample No. 1 during the storm exhibits a lower ratio than the one after because it had more transparent particles than the normal city generated dust.

The large increase in *OD* near the blue end of the spectrum is rather surprising. Even if a K of 2 is assumed the ratios are so large for the coke and atmospheric dusts that it must be assumed that there is some additional phenomenon of interaction between particles and filters. No adequate explanation for this phenomenon has been found.

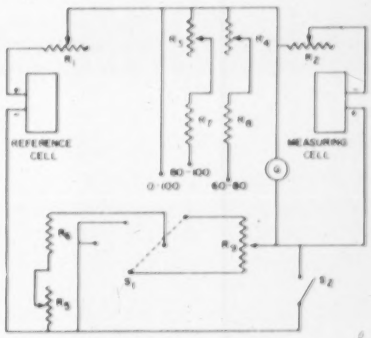


Fig. 5 — Photometer Circuit
R_1 and R_2 — 200Ω; R_{3a}, R_4 and R_5 — 2Ω; R_6 — 24Ω 1 percent; R_7 — 99Ω 1 percent; R_8 — 74Ω 1 percent; R_9 — 25Ω 0.1 percent linearity 10 turn pot; S-2 — DPST lever switch; S-1 — 4 pole, 3 position switch; G — 0.001 a A/mm electronic null indicator.

From these experiments it was concluded that there is no practical advantage in using a particular wave length band with the present photometer. It was also concluded that the possible effects of different light sources and lamp color temperatures would be negligible.

Table 6—Ratio of Measured to Calculated Optical Densities for Different Light Wave Lengths. ($K = 1$) MF Filters Used

Gelatin Filter No.	Color	λ mμ	Dust: Arizona Fine	Coke	Atmo. 1*	Atmo. 2*
None	White	370-700[b]	0.095	1.24	1.05	2.20
29	Red	over 605	0.82	1.37	0.97	2.25
15	Yellow	over 510	0.82	1.24	0.89	2.16
58	Green	480-600	0.18	1.50	1.24	2.57
15 + 58	Green	510-600	0.28	1.91	1.42	3.15
45	Blue	440-540	0.41	2.45	1.98	4.11
47	Blue-Violet	370-520	0.72	6.17	4.94	9.81

*The atmospheric samples were collected from air and evaluated by the procedures described in Ref. 7.
[b]Figures in this column are wave lengths in millimicrons.

Improved Photometer for Dust Spot Lint Screen and Dust Fall Measurement

To use the glass fiber and millipore filters for dust spot measurement requires a photometer of higher sensitivity than can be conveniently obtained with the previously used simple circuits. In the simpler pho-

tometers, the output of a single self generating photocell is measured by a microammeter[5, 6, 7, 8] or in some cases is balanced against a battery as in the Wood circuit[1, 10]. These simple circuits suffer from several disadvantages. Satisfactory stability requires the use of a battery or high grade voltage regulator for the lamp power source. Also the best readibility is on the order of 0.3 percent. For these and other reasons, a much more stable balanced photocell photometer was developed.

The basic design is that described by Brice[11] and illustrated in Fig. 4. A collimated beam from the light source is split into 2 parts. One part is reflected by a first surface mirror onto the dust spot* to be measured, and the remainder passes on to a reference photocell. Drift caused by unequal heating of the photocells has been minimized by a water cell and placement of the light source away from the cells. Reference and measuring photocells are connected in a series circuit as shown in Fig. 5. R_b is a 25 ohm, 10 turn potentiometer which serves to measure the ratio of the light falling on the measuring photocell to that falling on the reference cell. G is an 0.001 μ A/mm sensitivity electronic null indicator.

Three reading ranges are incorporated into the instrument shown in Fig. 6. The 0-100 percent range is used for dust spot and lint screen* measurements and the 30-100 and 60-30 percent ranges for dust fall* measurements. Switch S-2 is a shorting switch, provided to make it unnecessary to return R_b to 100 percent when standardizing the circuit.

High output selenium photocells are to be preferred although a pair of any well matched cells can be used. Rheostats R_1 and R_2 are used to compensate for any residual mismatching of the photocells. These rheostats are adjusted until variation of the lamp voltage produces minimum movement of the galvanometer. Because of the low resistance of this circuit, low resistance switches, heavy wire and good contact must be used throughout.

An adjustable diaphragm is placed just below the filter holder to control the size of the illuminated area on the filter and another just in front of the measuring photocell to control its angle of acceptance. The holder shown in Figs. 7 *a*, *b*, *c*, is designed to accomodate unmounted 47 mm disks of filter media, 25 mm wide microscope slides and 2 × 2 in. glass slide covers. The hinged lid mounting the measuring photocell is held shut by a small magnetic cabinet latch.

Two shutters are provided in front of the reference photocell. The coarse shutter which slides in a groove in the end of the box is made of 2 pieces of sheet aluminum so that a piece of filter medium can be slipped between. This provides better balance between the 2 cells for dust spot measurements. The fine shutter slides in grooves in a metal mount and is adjusted by a fine pitch screw from the front. Both shutters must be rigid and free from play.

Several different light sources have been used. For most purposes a 6 Volt, 20 cp lamp with suitable condensers is satisfactory. For measurements at reduced aperture on relatively opaque filter materials or when colored filters were used, a 200-w slide projector was used as a source. With any source, the light path from lamp to the photometer box must be completely enclosed to prevent instability caused by turbulent convection currents around the lenses.

Dust Spot Measurement Procedure: The instrument is first standardized by placing the appropriate standard on the holder and then adjusting the shutters with the potentiometer set at 100 or S-2 closed. The clean filter is then put in place and its light transmission read by turning the potentiometer until null is reached. A similar procedure is followed after the sample has been taken.

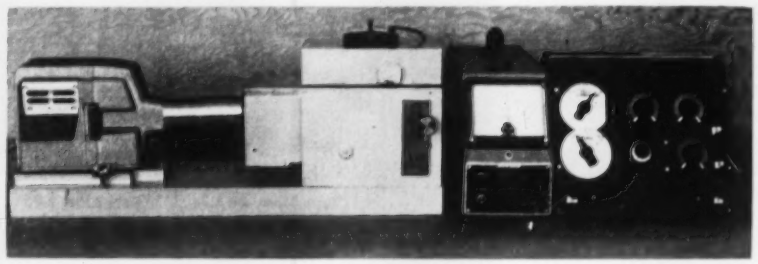


Fig. 6 — Improved photometer

Photometer Performance: This photometer possesses a number of desirable characteristics. Readibility is excellent. On the 0-100 scale, 1 potentiometer division represents 0.1 percent transmission while on the 30-100 and 60-30 ranges, 1 division represents 0.02 percent. The rugged electronic galvanometer with its logarithmic scale makes for easy, rapid balancing with no danger of over-ranging. Sensitivity and stability are such that 0.1 percent reproducibility is easily obtained when measuring the light transmission of glass fiber or millipore filters. Stability on the 30-100 and 60-30 ranges after a 15-min warmup is sufficient to obtain a reproducibility of about 0.04 percent when measuring the light transmission of dust fall slides.

Optical Arrangement of the Measuring Photocell: In a previous paper[7] it was shown that with the particular photometer used, the *OD* of a given dust spot could be different with the dirty surface away or toward the light source. Similar effects have been noted by Davies and Aylward[8]. In a discussion of Reference 7 by Davies he suggests that this effect is due to the difference in effective scattering angle of the particles in the 2 positions. Subsequent research with the improved photometer has suggested that it is the very high angle rays

*The optical lint screen and dust fall measurement techniques being used in the ASHAE dust survey will be described in a future paper.

leaving the filter which causes this effect.

It was found that if the light rays leaving the filter medium at angles near $\Theta = 90$ deg were prevented from reaching the photocell, then flat black to prevent high angle rays from reaching the photocells.

A further advantage of this optical arrangement is that the Lambert-Beer law is obeyed better at higher optical densities.

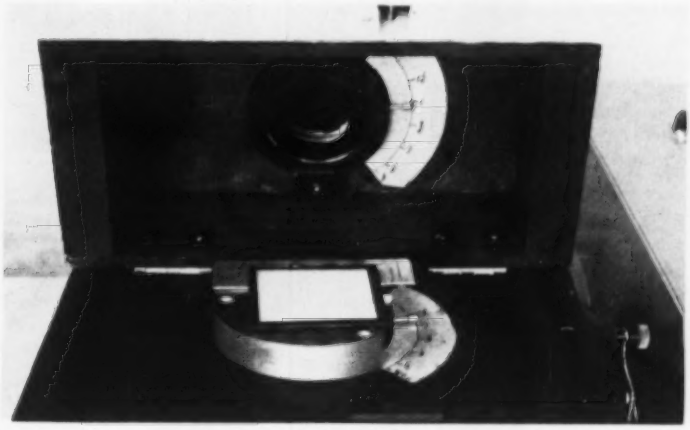


Fig. 7a — Sample holder of photometer with standard in place

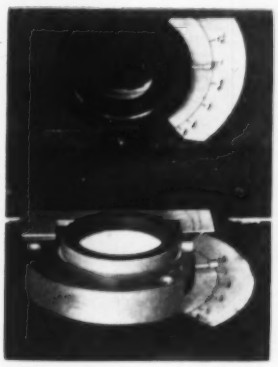


Fig. 7b (*left*) — Sample holder of photometer with filter in place

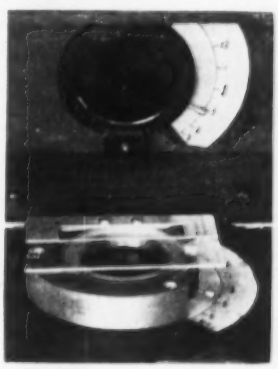


Fig. 7c (*right*) — Sample holder with microscope slide

there was no measurable difference in the *OD* with the dirty surface away or toward the photocell. Most simple photometers used by other investigators as well as the one used previously[7] have the photocell mounted close to the media in a polished metal sleeve to increase photocell output. This has been found to be undesirable. Detailed investigation by Engebretson[9] has shown that if the semi-angle of acceptance, Θ, of the measuring photocell is between approximately 20 and 30 deg, then the *OD* is nearly independent of Θ. This optimum angle is obtained with $d_0 = d_1 = 25.4$ mm and $\Theta = 26.5$ deg, Fig. 4. The diaphragms and the inside of the photometer lid are

Conclusions

From this study of the dust spot method, a number of conclusions have been reached.

1. For precision dust spot measurement of air cleaner performance, glass fiber paper and millipore filters have been found superior to the chemical papers ordinarily used.

2. A study of the *OD-C* relationship for the different media has shown that the glass fiber and millipore filters are very nearly linear for optical densities below 0.3, while the W-41 chemical paper is relatively non-linear at all optical densities.

The linearity of the *OD-C* relationship has also been found to depend on the optical system of the photometer and on the dust being sampled.

3. A theoretical explanation for the non-linearity of the *OD-C* relationship has been proposed. This theory indicates that the non-linearity is due to unequal rate of *OD* increase on different areas of the sampling media.

4. The optimum semi-angle of acceptance of the measuring photocell has been found to be between 20 and 30 deg. An optimum optical design has been recommended.

5. An improved null type photometer having greater sensitivity, accuracy, convenience, and flexibility has been developed for dust spot measurement. The greater sensitivity of this photometer is necessary to utilize the relatively opaque glass fiber and millipore filters under the optimum conditions of measurement recommended.

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3. A Photoelectric Instrument for Counting and Sizing Aerosol Particles, by F. T. Gucker and D. G. Rose (*British Journal of Applied Physics*, Supplement No. 3, 1954, p. S130).

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The President's Page

People Working Together

PEOPLE WORKING TOGETHER are three meaningful words to me. It is true that in formal language the detailed purposes of the Society are as set forth in the Charter and By-Laws, namely *to advance the arts and sciences of heating, ventilating, cooling and air conditioning for the benefit of the general public.* However, to me, all this can be largely summed up by the three simple words PEOPLE WORKING TOGETHER.

I also like to keep in mind that this same essential idea is made use of in many places besides in a national engineering society. For example, both small and big business have found that the collective intelligence of a group is greater than the intelligence of any one of the individuals in that group. It is because of this that research teams and design groups are so much in use in a lot of our modern industrial establishments and research institutions. Groups are likely to produce results. This does not mean that the talents of the individual are being circumvented, but with the wide breadth of scientific knowledge becoming available, group effort is almost an essential.

Our Society is made up of people of many talents and callings, including teachers of engineering, research scientists, consulting engineers, engineering administrators, sales engineers, contracting engineers and, to some extent, engineering technicians. In this respect, we are similar to many other organizations, but we also differ from certain groups, especially in the medical and legal professions, which are so specialized that their members are engaged in professional work within an extremely narrow specialty. ASHAE covers a wide diversification of both people and interests, but those interests all revolve around a single field of endeavor to such an extent that over the years, our Society has developed into a very friendly group.

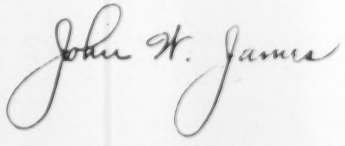
Occasionally, people mention to me that perhaps local groups or chapters are to be preferred to a single national organization. However, I believe that for unity of purpose and action, a large central organization can carry a diversified group further than almost any amount of local effort.

Personally, I would no more want to be an engineer in an industry without a national engineering society than to live in a community without churches. Just as churches set the moral fabric and environment in which to live and raise a family, so do national engineering societies set ethical and scientific standards for the engineering phases of the operation of an industry.

It is because our Society does have a diversified membership and covers diversified interests that we are in a unique position to take advantage of the concept of PEOPLE WORKING TOGETHER. We are thus able to follow a middle-of-the-course direction, operating at a level somewhere between the interests of the highly scientific person at the one extreme, and the practicing technician at the other.

As might be expected, and understandably, determination of the Society's course is constantly under review and under discussion. There are those who would have us move in the direction of devoting our efforts entirely to the scientific phases to the exclusion of the practical applications. Others sometimes feel that our present course tends too much toward the trade association level. However, still other members are of the opinion that our present effort is directed too much toward the ivory towers of science. Such discussions and such variations in viewpoint should not be thought of as a split in interest but as the normal course of events when we have PEOPLE WORKING TOGETHER. It is really an example of team effort with the team discussing its next plays.

It also seems that, increasingly, the future course of the Society will be determined not only by the views of individual members, but by group actions of the chapters as well. It seems to me, therefore, that one way to exert your influence in this connection is to make sure that your own chapter is constantly alert to the demands of the changing times; that its views are heard at committee meetings and at Annual and Semi-Annual Meetings of the Society. In other words, exert your own chapter influence so far as possible toward helping this idea of PEOPLE WORKING TOGETHER.



President
AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS

Part of Chicago's Lake Michigan shoreline from the Planetarium. To the left is the Conrad Hilton Hotel and at the right center is the new Prudential Building

Record Attendance Expected At Society 63rd Annual Meeting

Chicago in '57 is the current big topic of conversation among Society members everywhere. This lively interest and the early return of hotel reservation forms could indicate a record registration for the 63rd Annual Meeting and 13th International Heating and Air-Conditioning Exposition the week of February 25 to March 1, 1957.

In anticipation of a large attendance the plans of the Illinois Chapter Committee on Arrangements are already well advanced for making this Chicago visit an occasion members will recall often with many pleasant memories.

At a recent meeting of the Committee on Arrangements it was announced that the banquet speaker will be a man well known for his weekly inspirational radio program. He is Dr. Preston Bradley, pastor of Peoples Church, Chicago. Members may recall that Dr. Bradley spoke at one of the sessions of the 59th Annual Meeting in Chicago in 1953.

Dr. Bradley founded the Peoples Church in 1912. In addition to his church duties and radio program he has written a number of books, including *Courage for Today, Mastering Fear, Life and You, Meditations,* and *My Daily Strength.*

The Committee also has in progress plans for a welcome luncheon on Monday and a get-together party on Monday evening, according to P. J. Marschall, general chairman.

Sightseeing and other events, including a style show, are now under consideration and the Committee expects to offer the ladies a schedule of pleasant diversions during their visit to Chicago.

The city of Chicago itself is quite proud of such institutions as the Adler Planetarium, the Art Institute, Academy of Sciences and Natural History Museum. The Art Institute contains a world-famous collection of paintings, prints and sculptures; and the natural history of the Chicago area is displayed in exhibits at the Academy of Sciences.

ASHAE registration headquarters will be in the Conrad Hilton beginning Sunday, February 24, at 10:00 a.m. The opening session will be on Monday morning and subsequent sessions, for the presentation of 13 papers and 2 symposiums, have been scheduled leaving ample free time for attendance at the Exposition and participation in committee meetings. The Exposition hours at the International Amphitheatre will be: Monday, 2:00 p.m. - 10:00 p.m.; Tuesday, Wednesday, Thursday, 12:00 p.m. - 10:00 p.m.; and closing day, Friday, 12:00 p.m. - 6:00 p.m.

Interesting sessions, the spectacular Exposition, Illinois Chapter hospitality and Chicago's many points of interest are four very good reasons for bringing the family to Chicago in '57. Make hotel reservations now and, if traveling by air or rail, avoid last minute disappointment by making early transportation arrangements.

Tentative Program for Technical Sessions

Sunday — February 24

10:00 a.m. REGISTRATION

Monday — February 25

9:00 a.m. REGISTRATION

9:30 a.m. FIRST SESSION

Call to Order — Pres. John W. James

Greetings by P. J. Marschall, Chairman Committee on Arrangements

Report of President — John W. James

Report of Council — A. V. Hutchinson

Report of Treasurer — R. A. Sherman

Study of Three Redwood Cooling Tower Packings, by W. W. Smith

Earth as Heat Source and Sink for Heat Pumps, by D. M. Vestal, Jr. and B. J. Fluker

From '36 to '56: Air Conditioning Comes of Age, by W. A. Grant (tentative)

Tuesday — February 26

9:00 a.m. REGISTRATION

9:30 a.m. SECOND SESSION

Call to Order — 1st Vice Pres. P. B. Gordon

Report of Committee on Research — B. H. Jennings, Chairman

Vice Chairman — B. H. Jennings

Revised Winter Outside Design Temperatures, by H. C. S. Thom

Analysis of an Air-Conditioning Thermal Circuit by an Electronic Differential Analyzer, by C. V. Parmelee, P. Vance and A. N. Cerny (by title only)

Pulsations in Residential Heating Equipment — Preliminary Results, by A. A. Putnam and W. R. Dennis

The Dust Spot Method for Evaluating Air Cleaners, by K. T. Whitby, A. B. Algren and R. C. Jordan

9:30 a.m. THIRD SESSION

Call to Order — Treas. R. A. Sherman

SYMPOSIUM ON DEHUMIDIFICATION

John Everetts, Jr., Moderator

Dehumidification by Refrigeration — Walter E. Ellis

Dehumidification by Solid Sorbents — W. L. Ross

Dehumidification by Liquid Sorbents — E. W. Gifford

Economics of Dehumidification as Related to Storage — G. A. Higgs

Typical Problems and Their Solution — E. R. Queer

Wednesday — February 27

9:00 a.m. REGISTRATION

9:30 a.m. FOURTH SESSION

Call to Order — 1st Vice Pres. P. B. Gordon

Performance of Covered Hot Water Floor Panels, Part II, by E. L. Sartain and W. S. Harris

Cold Wall Effects in a Ceiling-Panel-Heated Room, by L. F. Schutrum and T. C. Min

Thermal Design of Warm Water Concrete Floor Panels — A Design Manual prepared by a subcommittee of TAC on Panel Heating and Cooling and members of the staff of the ASHAE Research Laboratory

9:30 a.m. FIFTH SESSION

Call to Order — 2nd Vice Pres. E. R. Queer

INDUSTRIAL VENTILATION SYMPOSIUM

C. H. Pesterfield, Moderator

Control of the Industrial Environment — P. J. Marschall

Local and General Atmospheric Contaminants Control — K. E. Robinson

Cleaning Industrial Effluent — J. M. Kane

Summer-Winter Comfort Ventilation for Industry — B. R. Small

The Inertia of Dust Particles and Various Consequences — W. C. L. Hemeon

Thursday — February 28

9:00 a.m. REGISTRATION

9:30 a.m. SIXTH SESSION

Call to Order — Pres. John W. James

Outlet Characteristics That Affect Downthrow of Heated Air Jets, by Shee-Mang Yen, Wilson Tripp and Linn Helander

Air Flow in Free Convection over Heated Bodies, by T. F. Hatch and D. Barron-Oronzco

Radioactive Process Ventilation, by S. H. Glassmire, Jr. and J. B. Wahlen (tentative)

Report of Resolutions Committee

Unfinished Business

New Business

Adjournment

Buckingham Fountain in Grant Park

Committee Statement on†

Atomic Energy in Heating, Ventilating, and Air Conditioning

By W. A. Grant*, Syracuse, N. Y.

The rapid progress of nuclear science and engineering continually poses to progressive members of our Society the questions: Where do we stand today? In what directions can developments be expected? What are the present and future economics? What will be tomorrow's impact on the heating, ventilating and air-conditioning industry? Will conventional approaches become obsolete? If so, how soon?

In backing away to take a good look, we should resolve neither to be awestruck nor frustrated by the wonders of the atom. Nuclear engineering, despite its formidable problems, is not difficult for a learned engineer to understand.

Man has harnessed two processes for releasing nuclear energy. The fission process for splitting the atom is achieved on a small scale with the particle accelerator, and on a larger scale in the nuclear reactor. The fusion or thermonuclear process for combining atoms has so far been utilized only in the H-bomb. In the foreseeable future, only the fission process offers controllable release of energy at usable temperature levels.

The nuclear fission reactor is a *furnace* which burns as fuel one of the radioactive elements. When the energy released is to be employed for heating or power generation, its economic usefulness must be judged alongside other types of furnaces and fuels on an investment, operation, and maintenance cost basis.

The design and construction features required to assure safety of nuclear furnaces add greatly to their cost. Radiation shielding is bulky, spent fuel elements must be replaced by remote handling techniques, control equipment is complicated, and precautions to safeguard operating personnel are expensive. These and other fixed costs appear to limit reactors for the near future to relatively large sizes. It now seems likely that within a few years package reactors will become economical for power generation in those parts of the world where other fuels are scarce. Eventually, as costs come down, they may compete with conventional fuels in this country. As a corollary, heating reactors may also prove feasible for central heating or for heat-operated refrigeration, such as required by an entire community or a group of large buildings. On the other hand, all evidence today indicates that nuclear reactors for the home are technically and economically unsound.

Note that in the power reactor the useful energy is withdrawn entirely as heat. While none of us should be surprised, even within our lifetime, to see a large proportion of the energy from nuclear reactions converted directly into electricity or other high-level forms of energy, no mechanism for achieving this conversion efficiently has yet been devised.

A recently publicized invention, the atomic battery, converts radiation into minute quantities of electricity. However, its efficiency is far too low at present to promise economic importance.

Some by-products of the controllable fission process could have an important impact on our industry. The use of radioactive waste material from nuclear furnaces to sterilize food products may be considered complementary or perhaps competitive to low-temperature air conditioning and refrigeration. Research in this area is promising, but the impact of this technological development cannot yet be assessed.

Waste fission products have also been proposed for the heating of buildings, since radioactivity is ultimately dissipated as heat. But design calculations are not encouraging. The quantity of material needed to heat an average home would emit a fantastic amount of radiation, and the whole apparatus would have to be buried deep in the ground to avoid hundreds of tons of concrete shielding. Since radioactivity decreases with time, the material might have to be replaced every year or two. While the difficult heat-exchange problems might be solved, the costly safety precautions connected with installation and maintenance appear to disqualify the entire scheme.

Radioactive tracer materials are already useful industrial tools, particularly in the field of measurement. They will undoubtedly assist in industry's research, manufacturing and quality control programs in the future. We might find radioisotopes useful in the quantitative measurement of air distribution.

Our members have an interest in and some have responsibility for installations making use of nuclear reactions or their by-products. One problem involves the proper ventilation of radioactive areas in laboratories to prevent contamination of personnel. Another pertains to the removal of radioactivity from stack effluent. A third problem is protection of personnel from fallout due to nuclear accidents. These are all filtering problems, involving air cleaning devices of exceptionally high effectiveness. Members of our Society may well be concerned with the design of protective shelters for civil defense, since provision for uncontaminated air is, next to blast protection, the most important requirement.

Summary

1. Nuclear furnaces will some day be economically important for power genera-

†This is a statement of the recently organized Council-appointed Nuclear Energy Engineering Committee. Personnel: R. A. Sherman, chairman, W. F. Friend, W. A. Grant, L. N. Hunter, B. H. Jennings.

*Vice President, Central Engineering Staff, Carrier Corp. Member of ASHAE.

tion, and for heating large groups of buildings.

2. Radioactive waste products hold some promise for food preservation and in the chemical industries.

3. Radioactive tracers are becoming important measuring tools in research, manufacturing, and quality control.

4. Design and application of suitable filtering means for personnel protection is a business today, and in a national emergency could become tremendously important.

What the long-range future may bring, who can tell? Anything is possible!

HOFMANN JOINS SOCIETY STAFF

The staff at the Headquarters office has been augmented by the arrival of Frederick W. Hofmann who assumed his new

Frederick W. Hofmann
New York, N.Y.

duties as assistant to the executive secretary on September 24.

The Officers and Council as well as the headquarters staff welcome his coming, especially in view of his bringing to his new duties an outstanding record of accomplishment.

Mr. Hofmann is a native of New Britain, Conn., and was educated in journalism at Hillyer College in Hartford, as well as having pursued the study of writing at Columbia University. He also brings to the Society staff the benefit of 12 years experience in trade association work, in newspaper editing and reporting, and in public relations activity.

From late 1954 to the spring of 1956, Mr. Hofmann was connected with *American Transit Association*, New York. The Association serves some 450 transit companies and manufacturer suppliers. With the Association, his duties included the re-writing and supervision of production of manuals; preparation of news releases; creation of advertising aids and promotional pieces, as well as the handling of correspondence covering films produced by the Association. He acted as managing editor of the Association's publication *Passenger Transport*, a weekly newspaper, and was in charge of many phases of the advertising in that same publication. He was also secretary of the entertainment committee for their annual convention.

As assistant to the executive secretary, he will assist in the planning and arranging of meeting programs, work with the chapters to implement the new regional plan and coordinate special committee activities. As a member of the administrative staff, his efforts will undoubtedly improve the Society's services to the membership.

WHAT SOCIETY COMMITTEES ARE DOING

The autumn is always a period of the year when Society Committees are most active, although their work is really continuous. Many committees have met recently and highlights of these meetings are reported here. Other committees have taken actions of interest even though they have not held formal meetings.

Special Committees

Of the nine special committees now active, three held meetings in late September.

ASHAE-*ASRE Committee on Cooperation* — held its organization meeting on September 21 at the Hotel Morrison in Chicago. A. J. Hess was elected chairman with L. N. Hunter as vice chairman. R. C. Cross was appointed as secretary of the group.

The Committee voted to indicate that it believes that the Committee should be made permanent and that it should meet regularly once a year with the meetings alternating at the time of the Annual Meeting of each Society.

The Committee also discussed the matter of the definition of air conditioning and felt that it was desirable for both societies to endeavor to agree on the same definition in order that it might be presented as a uniform recommendation on the part of both groups.

The Committee also felt that it would be desirable to work out a procedure for providing speakers from local chapters and sections from both Societies to present subjects of interest to local groups such as architects, service and luncheon clubs, and similar organizations. It was also felt that national and regional officers of both groups could very well be called on by both Societies in this type of activity.

The Committee also voted to recommend that when codes and standards of joint interest are being prepared, their preparation should be undertaken jointly.

It was also suggested that each Society should approve the codes adopted by the other in the interest of uniformity.

The Committee discussed at some length the matter of joint meetings between sections and chapters of the two Societies and felt that such meetings, some of which have already been worked out, are desirable.

Another item of interest at the meeting was the discussion of whether codes and standards for safety in building construction should be undertaken as well as standards and codes for rating and testing equipment.

The next meeting of the Committee is to be held at the time of the ASHAE Chicago Meeting in February 1957.

Long-Range Planning Committee — at its meeting in Chicago on September 22 at the Hotel Morrison, completed its organization by designating John E. Haines as chairman and J. Donald Kroeker as secretary.

Guide Advisory Committee — This committee also met in Chicago on September 21 at the Hotel Morrison and continued its consideration of proposals for changes in some of the publication methods to be used in future issues of THE GUIDE.

New Program Subcommittee Organized

For some time, A. J. Hess, Los Angeles, Calif., has been in the process of organizing a subcommittee to act in an advisory capacity to the Program and Papers Committee. The organization is now completed and the members of the Committee announced.

The general purpose of the committee is to advise the Program and Papers Committee by suggesting additions or improvements to programs of the national meetings of the Society. Members of the subcommittee are expected to keep the Program and Papers Committee advised of their own ideas concerning desired views in Society meeting programs as well as ideas or suggestions received from others. It is planned that the subcommittee shall operate through the already organized technical advisory committees, since it is felt that in this way the Program and Papers Committee can be best kept advised concerning the wishes of members regarding meeting organization and meeting content.

It is expected also that this subcommittee will serve to make available much needed manpower in connection with the preparation of meeting programs since in the past there has been a scarcity due to the necessarily limited membership of Council.

Names of the members of the new subcommittee are printed here and it is suggested that any members of the Society who have ideas, suggestions or thoughts concerning desirable features for future Society meeting programs should get in touch with any member of the Committee. A. J. Hess, Chairman, 1706 S. Main St., Los Angeles 15; D. L. Angus, 25 Bayview Wood, Toronto, Ont., Canada; W. P. Chapman, 3816 North 40th St., Milwaukee 16; L. F. Christofferson, 425-1411 Fourth Ave. Bldg., Seattle 1; C. W. DeLand, 6138 N. Clark St., Chicago 26; R. L. Evans, 4030 Chouteau (Rm. 212), St. Louis 10; C. B. Gamble, 635 Commercial Pl., New Orleans 12; A. S. Gates, Jr., Dept. of Navy, Bureau

of Ships, Washington 25; J. B. Graham, 190 Broadway, Buffalo 5; Linn Helander, Dept. of Mechanical Engrg., Kansas State College, Manhattan, Kans.; Fred Janssen, 1123 W. Third Ave., Denver; G. A. Linskie, 2608-A Inwood Rd., Dallas 19; P. J. Marschall, 14th & Sheridan, No. Chicago; W. O. Stewart, 615 N. Alvarado St., Los Angeles 26; H. E. Ziel, 345 New Center Bldg., Detroit.

Public Relations Committee Meets

One of the principal topics considered by this Committee at its meeting at the Hotel Morrison in Chicago on September 21 was the use to be made of the exhibit space of the Society at the coming 13th International Heating and Air-Conditioning Exposition. An entirely new exhibit is being prepared this year, intended to feature all of the principal activities of the Society. The Committee is most anxious that the best possible use shall be made of the exhibit space available.

Another topic had to do with plans for a proposed press conference to be held in Chicago at the time of the coming Annual Meeting in February. Since the Committee also is engaged in the preparation of a membership booklet for the Membership Committee and of some material intended to guide students toward the heating, ventilating, air-conditioning field, both these projects were discussed during the course of the meeting.

Standards Committee

The Standards Committee met on August 29 at the Statler Hotel in New York and the following actions were taken.

Organization of a Code — A committee to prepare minimum ventilation requirements for air-conditioned spaces was authorized. It is expected that the minimum will be interpreted to be the least acceptable value below which anyone should go in designing air-conditioning systems for human occupancy, and may take into account such factors as the volume of space and the floor area per occupant. The minimums selected are expected to be suitable for incorporation in local, state and national standards • • • The Society already has a Code Committee which is preparing Standards for Comfort Air Conditioning. At a meeting held in August, this committee prepared its fourth draft of the proposed standards, and anticipates that a final draft can soon be released for Society adoption • • • H. T. Gilkey has been appointed Society representative on a Task Committee organized by *ASRE* to revise the *ASRE* Standard 16-56, Methods of Rating and Testing Air Conditioners, so that it will include provisions for testing and rating residential units • • • An Advisory Committee is being appointed by the Standards Committee to consider the best means of providing chapter and local committees with assistance in the preparation of local regulations pertaining to heating, ventilating and air conditioning. This committee will make recommendations to the Standards Committee on both the need for assistance and the type of information that should be made available.

An ASHAE Standard Code for Testing and Rating Evaporative Air Coolers is being prepared by the members of the TAC on Evaporative Cooling, which have been appointed a Code Committee for this purpose. R. S. Ash is chairman of the Committee which has adopted as a scope for the code, *the determination of the saturation or evaporative efficiency of evaporative air coolers* • • • The Society has accepted sponsorship of a proposed *ASA* project for preparing an American Standard on Applications of Thermal Insulating Materials. M. W. Keyes, chairman of the TAC on Insulation, will be chairman of this committee • • • The TAC on Sorption, R. L. Simpson, chairman, has been appointed an Advisory Committee to complete a Method for Testing Sorption-Type Dehumidifiers. This project was initiated by the TAC, which submitted a tentative method for Standards Committee consideration • • • The Society has agreed to participate, with *ASME*, *Cooling Tower Institute*, and *Air-Conditioning and Refrigeration Institute* in an *ASA* project for preparing an American Standard on Industrial Cooling Towers. Two sets of standards will be prepared, one for field-erected towers and the other for factory-assembled towers. *ASME*, *ARI* and *CTI* have been invited by *ASA* to act as sponsors. It is anticipated that the project will be started as soon as the sponsors have agreed to accept the responsibility.

Recent appointments of Society representatives by the Standards Committee have been: Albert Giannini, as chairman of the committee to prepare minimum ventilation requirements for air-conditioned spaces; A. W. Knecht — *ASTM* C-20 on Acoustical Materials, and *ASA* Sectional Committee A62, Coordination of Dimensions of Building Materials; R. P. Gaulin — *NFPA* Committee on Operating Rooms; A. D. Brandt — *ASA* Sectional Committee Z62, Uniform Industrial Hygiene Standards.

Committee on Research Meets

On September 20, at the annual budget meeting at the Research Laboratory, the Committee on Research approved a budget for $248,230 for research during 1957. This is the largest research budget in the Society's history, a 10 percent increase over the 1956 budget.

Approximately half of the funds needed are to be made available by contributions from industry, and the balance from membership dues and from Exposition income.

The major new project to be launched will be a study of human comfort as influenced by humidity and radiation. This project will be the forerunner of studies on human subjects in special test rooms to measure human performance under various conditions of air temperature, humidity, air motion, and radiation. The Committee witnessed construction work in progress to provide additional test facilities at the Laboratory in Cleveland.

The budget also provides for studies of heat transfer through windows with various types of shading devices, for which the Society has recently improved its solar calorimeter. An intensive investigation on infiltration through building entrances, started in 1956, will soon advance to a motion picture study of traffic flow through entrances and the resulting door motions. The research on fan noise is to be completed early in 1957 and a new project activated on sound attenuation in duct systems.

The Society will continue its research on odor adsorption and desorption by fabrics, hot water and steam heating, periodic heat flow through walls, and air distribution. Projects will also be sponsored on sorption, dehumidification, solar collectors, and combustion pulsations.

Other Committee Meetings

Meetings were also held in Chicago in the latter part of September by the *Executive Committee* and the *Finance Committee* of *Council* as well as by the *Charter and By-Laws Committee* which met in headquarters office on September 21.

★ ★ RECENT SOCIETY CHAPTER EVENTS ★ ★

Chapter meetings in the last few months have included presentations which proved to be of special interest to Society members and their guests. Features of these Programs are described here, along with some notes on the People whose names figured prominently at these meetings. Presentation of its charter to the 64th Chapter (Illinois-Iowa) is reported.

Illinois-Iowa Chapter Organized

Pres. John W. James, Chicago, Ill., presented the charter of the Illinois-Iowa Chapter to R. L. Graham, chapter president, at the inaugural meeting, September 19, in the LeClaire Hotel, Moline, Ill., where 75 were in attendance. The chapter membership is in the area from the cities bordering the Mississippi River to Peoria.

The officers elected were: *President*—R. L. Graham, Rock Island; *Vice President*—W. W. Dodge, Peoria; *Secretary*—D. H. Ninow, Moline; *Treasurer*—E. O. Hull, Peoria; *Board of Governors*: W. L. Davis, Keokuk; C. P. Rohde, Cedar Rapids; and J. M. Hartman, Kewanee.

Following a social hour and dinner, the meeting was called to order by R. L. Graham who introduced Mr. Taylor who extended greetings on behalf of the city and the local engineers.

Mr. Graham then presented visiting members and guests: John E. Haines, Minneapolis, regional director of Region 3; John Everetts, Jr., Philadelphia, regional director of Region 1; H. G. Gragg, Chicago, president of Illinois Chapter; H.

Journal Section

E. Schroeder, Des Moines, president of Iowa Chapter; and A. V. Hutchinson, New York, executive secretary of ASHAE.

It was announced by Mr. Graham that he had received messages from P. B. Gordon, 1st vice president of the Society, and other officers and members of Council; G. B. Supple, Indianapolis; and from the officers of 30 other chapters.

President James spoke on the *Future of Air Conditioning and the Society*, particularly emphasizing the applications in industry, hospitals, schools and farms. He discussed the added efficiency and production by workers in industry; described the studies of Detroit Edison Co. in its service building, the lifesaving work in hospitals on premature infants, the advances in operating room techniques, the renewed interest in ozone, reduction in air quantities in Wisconsin schools and the interest in determining the pupils' rate of learning; and mentioned the improvement in attendance at a fully air-conditioned school at San Angelo, Texas. Mr. James pointed out the big market on the farm and referred to the Purdue University experiments on hog fattening using panel heating and cooling, and the work on poultry for growth and egg production. He told of electronic cooling methods in England.

In conclusion, he described the relationship of population growth to advance of heating, ventilating and air conditioning, and he felt that the growth pattern of the Society followed the growth of the industry. He predicted the present trend assured a Society of 12,500 members and 75 chapters by 1960. His opinion was that a Society such as ASHAE with everyone working together was a big factor in providing improved scientific and ethical standards for our profession.

Prof. Ez R. Queer, Pennsylvania State University, spoke on the *New Role of Chapters in Society Operations*. He briefly described the operation of the New Regional plan and the work of the Chapters Regional Committee and the Regions Central Committee. He explained that it would tend to bring the Society closer to the membership and he said it was important to maintain chapter vitality.

John E. Haines, regional director, said that it was the chapters' duty to permit the general public to know the advantages of air conditioning. He also pointed out that it was the Society's function through its meetings, its research, educational and publicity facilities to prove the advantages of modern heating, ventilating and air conditioning principles. Mr. Haines then presented the chapter record book to the secretary on behalf of the Council.

Programs

E. W. Klein, program chairman, ATLANTA Chapter, acted as moderator for a panel of consulting engineers and posed preselected questions to the panel members. The experts were J. W. Borum, Lazenby & Borum; D. F. Lindstrom, senior partner, Donald Lindstrom & Associates; J. C. Marlow, Robert & Company Associates; H. K. McCain, Newcomb & Boyd; and J. W. Austin, Jr., Atlanta, Ga. As a result the audience gained valuable information regarding the ethical and practical problems confronting the consulting engineer • • • BATON ROUGE Chapter members and guests enjoyed a tour of inspection of the 100-ton air-to-air heat pump installation at the Gulf States Utilities Building. R. T. Collier, air-conditioning engineer, Gulf States Utilities Co., Baton Rouge, La., explained that the heat pump shows promise because of balancing the summer air-conditioning load with the winter heating load. The designer of the system, C. S. Woodruff, partner, Woodruff & Dyer, Inc., Baton Rouge, told how a greatly enlarged outside air coil had effected complete heating from the central machine and at the same time provided a low maintenance installation • • • Means for *Designing Troubles out of Hot-Water Systems* were described by G. F. Carlson, engineer, Bell & Gossett Co., Morton Grove, Ill., at a DELTA Chapter meeting. A question and answer session followed the informative talk • • • A well-known consulting technical adviser, J. G. McGivern, dean of engineering, Gonzaga University, Spokane, Wash., spoke before the INLAND EMPIRE Chapter on *Requirements for the Professional Mechanical Engineers State Exam*. Dean McGivern, a member of the Washington State Board of Engineering Examiners, discussed engineering requirements for the high school student and the college undergraduate. The dean's talk was received with great interest • • • Both the KANSAS and KANSAS CITY Chapters heard H. E. Straub, research engineer, Titus Manufacturing Corp., Waterloo, Ia., and former research associate, department of mechanical engineering, University of Illinois, develop the topic, *Principles of Room Air Distribution*. Four basic types of outlets—floor, baseboard, sidewall and ceiling—were covered. The question-answer sessions following brought forth a number of interesting questions • • • Previous to their regular meeting, NEBRASKA Chapter members were taken on a tour through the Strategic Air Command Control Center, Offutt Air Force Base. The tour included the underground structure and 3-story administration building. Of interest were the 2250-kw diesel-generating plant, three 600-hp power boilers, and the two 1050-ton steam-driven centrifugal chillers. The presentation at the meeting, *The Utility of and Necessity for the Strategic Air Command Control Center*, was given by Major C. V. Ellis, special project officer, Strategic Air Command, United States Air Force. Major Ellis mentioned the use of the underground structure in case of atomic emergency, and the utility expected from the above ground administration building. Mr. Manchester, chief mechanical engineer, Corps of Engineers, explained the underground ventilation system and certain air-conditioning features • • • NEW MEXICO Chapter devoted an evening program to a moving picture entitled *To Enrich Mankind*, depicting the history and achievements of mechanical engineering from Archimedes' time to the present. This enlightening film was enjoyed by all those present • • • The legal side of the contracting business was the subject of a general discussion by Grover Hartt, former judge, County Court of Law, No. 2, before the NORTH TEXAS Chapter. Judge Hartt touched briefly on several aspects, including advance legal advice or preventative law practice, business organization types, the importance of proper wills, contract documents and modifications to those contracts, assignment of wage claims, and liens • • • An illustrated talk given to the SACRAMENTO VALLEY Chapter by Z. A. Marsh, Minneapolis-Honeywell Regulator Co., stressed the need for better heating and ventilating in school buildings. Mr. Marsh outlined the engineer's responsibility in school house planning • • • Members and guests of the WESTERN MASSACHUSETTS Chapter visited the Westover Air Force Base, where 5 speakers graced the rostrum. William Chesworth, U. S. Corps of Engineers, described the high-temperature high-pressure hot water heating system as installed and operated at Westover. Information on the amount and type of water required for the system was provided by Kenneth Lafley of Westover. A. E. Kent and Albie Petruzzo, Buerkel & Co., Inc., listed some of the system's advantages and engineering details, and Chester Daikin, Eighth Air Force Headquarters, told of applications of this system in other locations and in different Air Force installations • • • *Firm Specifications and Their Effects on Building Costs* was the title of a talk by K. M. Wilson, chief engineer, E. F. Klingler & Associates, Eau Claire, Wis., before an audience of WISCONSIN Chapter members and guests. The speaker pictured the construction industry as analogous with the automobile industry in that the progress of both is dependent upon close cooperation of all segments of the industry. Mr. Wilson spoke in favor of the base bid type of specification. He feels that this procedure allows the contractor to figure his costs more accurately, and gives the architect, engineer and owner rightful control of the equipment to be furnished.

People

A silent tribute was paid to a long-time member of the KANSAS CITY Chapter, W. T. Conroy, whose passing was announced by Pres. R. M. Spencer • • • T. H. Anspacher reported at a NORTH TEXAS Chapter meeting that the first loan made to a student by the Giesecke Memorial Fund had been repaid in full with interest • • • Results of the balloting at the WESTERN MASSACHUSETTS Chapter were as follows: *President* — J. E. Reed; *Vice President* — F. A. Ferraro; *Secretary* — C. R. Munn; *Treasurer* — J. J. Curran; *Board of Governors* — R. E. Cross, A. M. Lorenberg, K. W. Maki, Benjamin Washburn and J. F. Hayes • • • Pres. H. K. Forfar, WISCONSIN Chapter, announced his summer appointments to the Gustus L. Larson Award Committee: L. C. Plachn,

chairman, and B. M. Kluge, secretary, for 3-year terms; Paul Gayman, co-chairman, and F. W. Goldsmith, 2-year terms, and F. J. Nunlist, Jr. and Bert Fredericksen, 1-year terms; and I. J. Rossiter, retiring president, was automatically placed on the committee for a 1-year term. Ronald L. Kausch received the first Larson award.

CANDIDATES FOR MEMBERSHIP

Listed here are the names of 75 men who are candidates for membership or advancement in membership grade.

Members are requested to assume their full share of responsibility of receiving these candidates into membership by advising the Executive Secretary before November 30, 1956, of any whose eligibility for membership is questioned. Unless such objection is made these candidates will be voted upon by the Council.

Note: Advancement* Reinstatement†

Alabama *(Region 5)*

SHIELDS, V. G., Jr., Sales Mgr., Htg., & A.C. Dept., Hinkle Supply Co., Inc., Birmingham.

California *(Region 4)*

BRONDIJK, J. J., Designer, Daniel, Mann, Johnson & Mendenhall, Los Angeles.

COOMBS, M. L., Sales Engr., American Blower Corp., Los Angeles.

HSU, W. C., Mech. Engr., Daniel, Mann, Johnson & Mendenhall, Los Angeles.

KASIN, GERALD, Cons. Engr., G. Kasin & Assocs., San Francisco.

SARNEFORS, S. G., Design Engr., United Air Conditioning Corp., Los Angeles.

SHINODA, T. Y., Engr., Daniel, Mann, Johnson & Mendenhall, Los Angeles.

Connecticut *(Region 1)*

ROGERS, E. E., Sales Engr., Johnson Service Co., West Hartford.

District of Columbia *(Region 5)*

PORTER, C. W.†, Sales Engr., Joy Manufacturing Co., Washington.

Georgia *(Region 5)*

CLARY, E. M., Owner, Clary & Co., Atlanta.

MARKS, E. D., Jr., Sales Engr., Marks Heating & Air Conditioning Co., Augusta.

Illinois *(Region 2)*

AVERY, F. J., Chief Engr., Wilkins Pipe & Supply Co., Peoria.

GLOWACKI, A. M., Plant Elec. Engr., Corn Products Refrigeration Co., Pekin.

HEID, J. F., Sales Engr., The Trane Co., Peoria.

JOHNSON, D. G., Sales Engr., Russell & Smith, Inc., Peoria.

MURPHY, W. A., Jr., Sales Engr., The Trane Co., Chicago.

Indiana *(Region 2)*

CLEVELAND, R. E., Research Analyst, American Rock Wool Corp., Wabash.

GRAVENSTRETER, T. E., Mgr., Air Dryer Dept., Carrier Corp., Bryant Div., Indianapolis.

MILEY, C. L., Pres. & Owner, C. L. Miley & Co., Indianapolis.

Iowa *(Region 3)*

GREENMAN, D. R., Htg. Sales Engr., Plumb Supply, Inc., Mason City.

Kentucky *(Region 5)*

LEVINE, S. H., Pres., Air-Con Supply Co., Inc., Louisville.

OGLE, F. J., Jr., Owner, Ogle Engineering Sales, Louisville.

Louisiana *(Region 5)*

CRAIG, C. E., Jr., Charge of Southeast Office, H. E. Bovay, Jr., Cons. Engrs., Baton Rouge.

Massachusetts *(Region 1)*

MAYONE, L. B., Sales Engr., Boston Cooper Corp., Boston.

Michigan *(Region 2)*

BERGEN, H. A., Editor, Industry Power, Putman Publishing Co., St. Joseph.

KLINE, C. A., Jr., Chief Design Engr., United States Register Co., Battle Creek.

Missouri *(Region 3)*

BOWMAN, L. V., Owner, Lynn V. Bowman Heating & Plumbing Co., Kansas City.

CARLSON, L. B., Vice-Pres. in charge of Engrg., Wholesale Equipment Corp., Kansas City.

FERRIS, C. W., Mech. Engr., Bank Building & Equipment Corp., St. Louis.

GOLD, H. E., Engr., Kennard Corp., St. Louis.

HUGHES, H. H., A.C. Sales Engr., Missouri Natural Gas Co., Farmington.

LAWSON, J. M., Supt., Lawson's Plumbing, Heating & Air Conditioning Co., Fulton.

LICKTIEGER, I. E., Factory Field Serv. Engr., The Trane Co., St. Louis.

RICH, W. E., Sales Repr., The Trane Co., St. Louis.

Nebraska *(Region 3)*

GOODWIN, R. R., Jr., Partner, Wann Engineering Co., Omaha.

New Jersey *(Region 1)*

COLBY, R. P., Jr., Supvsr. Training, General Electric Co., Bloomfield.

New Mexico *(Region 6)*

LUJAN, PETER, Engr., Bridgers & Paxton, Albuquerque.

New York *(Region 1)*

BEEBE, FRED, Mech. Engr., United States Navy, New York.

CONEREDO, J. M., Squad Leader, Stevens & Wood, Inc., New York.

DeMARTINO, P. S., Jr., Designer, Stevens & Wood, Inc., New York.

ECONOMIDES, LEANDER, Chief of Design, Voorhees, Walker, Smith & Smith, New York.

JAHELKA, A. R., Htg. & Vtg. Engr., Vitro Corp. of America, Engineering Div., New York.

JOHNSON, A. S., Design Marine A.C. Engr., Byrnes Assocs., Stevens & Wood, New York.

PICCIANO, A. H., Checker, Stevens & Wood, New York.

SAVELL, O. O., Div., Chief, Stevens & Wood, New York.

SCHMECA, R. J., Designer, Checker, Stevens & Wood, New York.

WILEY, S. K., Jr., Htg. Engr., J. O. Ross Engineering Corp., New York.

North Carolina *(Region 5)*

KEHELEY, H. L., Br. Constr. Mgr., Carrier Corp., Charlotte.

SIMONS, W. B., Jr., Partner, Mec-Tric Control Co., Charlotte.

Ohio *(Region 2)*

BETSON, D. E., Sales Engr., American Blower Corp., Cincinnati.

HERZOG, M. C., Owner, M. Herzog Plumbing Co., South Euclid.

HUGHES, V. V., Chief Engr., Columbus Heating & Ventilating Co., Columbus.

KUEMPEL, J. L., Branch Office Engr., The Kuempel Co., Columbus.

VANDERHOOF, C. D., Treas., A. E. Vanderhoof, Inc., Cleveland.

Oregon *(Region 4)*

CRICHTON, R. M., Appl. Engr., Minneapolis-Honeywell Regulator Co., Portland.

ELY, M. M., Htg. Engr., Portland Gas & Coke Co., Portland.

HEMPHILL, A. W., Jr., Engr., Streimer Sheet Metal Works, Portland.

PROPST, R. L.*, Estimator & Dept. Head, M & N Sheet Metal Works, Milwaukie.

SCOTT, G. J., Vice-Pres., I. R. Nolte Co., Portland.

Pennsylvania *(Region 1)*

CLARKE, P. M., Serv. Mgr., McCreery Brothers & Co., Pittsburgh.

GRIBBLE, E. P., Research & Dvlpt. Engr., Shaw-Perkins Manufacturing Co., Pittsburgh.

WOLFSON, R. P.*, Research Engr., Franklin Institute, Philadelphia.

South Carolina *(Region 5)*

FREEZE, J. E., Br. Mgr., American Blower Corp., Greenville.

SMITH, H. A., Engrg. Asst., W. D. Harper & Sons, Archts. & Engrs., Florence.

Texas *(Region 6)*

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MALLOZZI, FRANK, Sales Engr., American Air Filter of Canada, Ltd., Montreal, Que.

McLEOD, D. S., Mech. Estimator, Canadian Comstock Co., Ltd., Toronto, Ont.

POTTS, R. E., Indus. Repr., Consumers Gas Co., Toronto, Ont.

PFESSER, G. S., Asst. Chief Engr., Air Conditioning Engineering Co., Ltd., Montreal, Que.

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CALLINAN, B. J., Sr., Partner, Gutteridge, Haskins & Davey, East Melbourne, Victoria.

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HAEBINGER, KURT, Gen. Mgr., Sevaric Air Conditioning & Refrigeration, Ltd., Rio de Janeiro.

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NEU, H. R., Mgrg. Dir., Etablissements Neu, Lille (Nord).

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OBITUARIES

HERBERT LEMKAU
San Francisco, Calif.

Word has been received of the death of Herbert Lemkau, on August 3, at the age of 52. Mr. Lemkau had been ill for several months, and had retired from his position as product application engineer, Crane Co., San Francisco.

Mr. Lemkau, a native of San Francisco, attended the Vocational High School in Oakland. He started with the Crane Co., Oakland, in 1923 and, continually advancing in sales work, became head of San Francisco and Oakland engineering sales for heating products in 1946. He joined the Society that year.

He is survived by his wife, who lives at their home in Oakland.

WILLIAM T. CONROY
Kansas City, Mo.

William T. Conroy, 61, a member of the Kansas City Chapter, died at the Downtown Hospital, Kansas City, September 5, following a heart attack.

Journal Section

Mr. Conroy, who was born in Kansas City, had been owner and operator of a heating and plumbing contracting business in that city for 37 years. He also covered refrigeration and utility work.

A member of St. Augustine Catholic Church, Mr. Conroy was a knight of St. Gregory. In addition to being a member of the Society for the past twelve years, he held membership in *HP&ACCNA*, Sertoma Club, Blue Hills Country Club, and Kansas City Club.

He leaves his wife, Ethel; five daughters, Miss Jean Conroy, Mrs. Mildred Irving, Mrs. Edith Gallagher, Mrs. Dorothy Strode and Sister Jean Thomas; two sons, Thomas G. and William T., II; a sister, Miss Mary Conroy; and thirteen grandchildren.

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(Continued from page 166)

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DISTRICT OF COLUMBIA

Washington, D.C.: 1935. Hdqrs., Washington, D.C. Meets, 2nd Wed. PRES, J. H. Broome, 4926 Wisconsin Ave. (16). SECY, J. W. Morgan, 2117 M Street, N.W.

GEORGIA

Atlanta: 1937. Hdqrs., Atlanta. Meets, 2nd Mon. PRES, F. W. Bull, 1205 Spring St., N.W. SECY, J. S. Edgar, 2015 Peachtree Rd., N.W.

ILLINOIS

Illinois: 1906. Hdqrs., Chicago. Meets, 2nd Mon. PRES, H. G. Gregg, 228 N. LaSalle St. (1). SECY, Herbert Kreisman, 117 N. Desplaines St. (6).

Illinois-Iowa: 1956. Hdqrs., Moline. PRES, P. L. Graham, 301 Safety Bldg., Rock Island. SECY, D. H. Nanow, 1824 3rd Ave.

INDIANA

Indiana: 1943. Hdqrs., Indianapolis. Meets, 4th Tues. PRES, A. C. Roche, Jr., 3960 Broadway (5). SECY, W. F. Curtiss, 619 Architects & Builders Bldg. (4).

IOWA

Iowa: 1940. Hdqrs., Des Moines. Meets, 2nd Tues. PRES, D. E. Schroeder, 2717 Cambridge. SECY, R. T. Howard, Jr., 220 Davidson Bldg.

KANSAS

Kansas: 1951. Hdqrs., Wichita. Meets, Tues. after 1st Mon. PRES, H. M. Skalla, 2639 Bennett (16). SECY, J. C. Mikesell, 5426 E. Pine (6).

KENTUCKY

Bluegrass: 1954. Hdqrs., Louisville. Meets, 2nd Mon. PRES, W. J. Killian, 215 Central Ave. (8). SECY, A. E. Handmaker, 500 Bergamin Ave. (8).

LOUISIANA

Baton Rouge: 1955. Hdqrs., Baton Rouge. Meets, 3rd Wed. PRES, J. T. Naylor, Jr., 5563 Greenwell Springs Rd., P.O. Box 4688 Audubon Station. SECY, W. J. Le Blanc, 1st Government St.

Delta: 1939. Hdqrs., New Orleans. Meets, 3rd Tues. PRES, H. N. Stall, 840 Baronne St. (12). SECY, O. F. Schully, 840 Baronne St.

Shreveport: 1948. Hdqrs., Shreveport. Meets, 3rd Thurs. PRES, H. L. Scott, 1020 Market St., P.O. Box 1821. SECY, L. E. Kneipp, P.O. Box 1382.

MARYLAND

Baltimore: 1949. Hdqrs., Baltimore. Meets, 3rd Wed. PRES, W. G. Robertson, Jr., 2315 St. Paul St. (18). SECY, C. E. McCaffray, Huntingdon Ave. at 26th (11).

MASSACHUSETTS

Massachusetts: 1910. Hdqrs., Boston. Meets, 3rd Tues. PRES, W. G. Martin, Jr., 64 Moulton St., Cambridge (38). SECY, F. J. Butler, 123 Malden St. (18).

Western Massachusetts: 1955. Hdqrs., Springfield. PRES, J. E. Reed, 57 Main St., Westfield. SECY, C. N. Munn, 29 Logan St.

MICHIGAN

Michigan: 1916. Hdqrs., Detroit. Meets, 1st Mon. after 10th of month. PRES, S. Livermore, 2000 Second Ave. (26). SECY, J. B. Olivieri, 37294 Elena M., Clemens.

Western Michigan: 1937. Hdqrs., Grand Rapids. Meets, 2nd Mon. PRES, F. L. Murray, 482 W. Michigan Ave., Battle Creek. SECY, R. J. Wanikes, 500 E. 8th St., Holland.

MINNESOTA

Minnesota: 1918. Hdqrs., Minneapolis. Meets, 1st Mon. PRES, S. S. Erickson, 502 Investors Bldg. (2). SECY, J. H. Jester, 621 E. Hennepin Ave.

MISSISSIPPI

Mississippi: 1953. Hdqrs., Jackson. Meets, 4th Mon. PRES, J. W. Doggett, Jr., 254 Kimbrough Dr. SECY, D. F. Ingram, 408 W. Fortification S.

MISSOURI

Kansas City: 1917. Hdqrs., Kansas City. Meets, 1st Mon. PRES, R. M. Spencer, 1510 Main St. SECY, J. E. Miller, 5830 Outlook, Mission, Kan.

St. Louis: 1918. Hdqrs., St. Louis. Meets, 2nd Tues. PRES, W. P. Norris, 6338 Waterman Ave. (5). SECY, K. O. Williams, 3200 Oliver Ave., E. St. Louis, Ill.

NEBRASKA

Nebraska: 1940. Hdqrs., Omaha. Meets, 2nd Tues. PRES, L. J. Paulsen, 1901 S. 39th St. SECY, E. N. Seiler, 1824 N. 53rd St.

NEW JERSEY

North Jersey: 1952. Hdqrs., Newark. Meets, 2nd Tues. PRES, W. C. Kruse, Jr., 183 N. 13th St. (7). SECY, S. H. Nitzberg, P.O. Box 157, Wood-Ridge.

NEW MEXICO

New Mexico: 1954. Hdqrs., Albuquerque. Meets, 3rd Tues. PRES, C. R. Wherritt, 4136 A Trinity Dr., Los Alamos. SECY, R. G. Merryman, 592 Kiva St., Los Alamos.

NEW YORK

Central New York: 1944. Hdqrs., Syracuse. Meets, 4th Wed. PRES, H. J. Morton, 122 Lincoln Ave. SECY, E. L. Moyer, R. D. 2, Jamesville.

Empire State Capital: 1951. Hdqrs., Albany. Meets, 2nd Wed. PRES, G. G. Davis, 11 S. Church St., Schenectady. SECY, M. L. Waddell, 1623 Central Ave.

New York: 1911. Hdqrs., New York. Meets, 3rd Mon. PRES, J. B. Hewett, 64 Buena Vista Dr., Dobbs Ferry. SECY, Carl H. Fink, 62 Worth St. (13).

Western New York: 1919. Hdqrs., Buffalo. Meets 2nd Mon. PRES, V. N. Harwood, 250 Delaware Ave. (2). SECY, J. F. Bedard, 505 Franklin St.

NORTH CAROLINA

Northern Piedmont: 1952. Hdqrs., Greensboro. Meets, 2nd or 3rd Fri. PRES, L. R. Gorrell, 1412 Chester Rd., Raleigh. SECY, C. E. Amick, 1042 Oakmont Ave.

Southern Piedmont: 1952. Hdqrs., Charlotte. PRES, J. A. Rice, 719 E. Worthington Ave. SECY, E. D. Streng, P.O. Box 4083.

OHIO

Central Ohio: 1944. Hdqrs., Columbus. Meets, 3rd Mon. PRES, W. A. Schoonover, 2901 N. High St. (2). SECY, R. C. Liebert, 623 N. High St. (11).

Cincinnati: 1932. Hdqrs., Cincinnati. Meets, 1st Tues. PRES, R. G. Anderson, 1758 Elmore St. (23). SECY, C. P. Krantz, 2308 W. 8th St. (4).

Miami Valley: 1950. Hdqrs., Dayton. Meets, 1st Wed. PRES, J. B. Rishel, 397 W. 1st St. (2). SECY, R. B. Walcott, 2340 E. River Rd. (9).

Northern Ohio: 1916. Hdqrs., Cleveland. Meets, 2nd Mon. PRES, H. R. Conoyer, 1900 Superior. SECY, R. D. Wilson, 2142 E. 19th St. (15).

Toledo: 1954. Hdqrs., Toledo. PRES, J. F. Guest, 1815 N. 13th St. SECY, Robert Greenwald, 2525 Portsmouth Ave. (13).

OKLAHOMA

Oklahoma: 1935. Hdqrs., Oklahoma City. Meets, 2nd Mon. PRES, F. R. Denham, 320 Oklahoma Natural Bldg. (2). SECY, W. R. Johnson, 120 E. Main.

Northeastern Oklahoma: 1948. Hdqrs., Tulsa. Meets, 2nd Tues. PRES, H. W. Meinholtz, Box 2261. SECY, H. L. Cauvel, 3342 East 41st St.

OREGON

Oregon: 1939. Hdqrs., Portland. Meets, Thurs. after 1st Tues. PRES, W. R. Norte, 2225 N. E. Broadway (12). SECY, G. G. Van Aist, 347 S. E. Market.

PENNSYLVANIA

Philadelphia: 1916. Hdqrs., Philadelphia. Meets, 2nd Thurs. PRES, C. J. Lubkin, 3345 W. Hunting Park Ave. (32). SECY, Ludwig Mark, 412 W. Hortter St. (19).

Pittsburgh: 1919. Hdqrs., Pittsburgh. Meets, 3rd Mon. PRES, R. M. Toucey, 223 Fourth Ave. (22). SECY, G. E. Smetak, 1238 Brighton Rd. (23).

SOUTH CAROLINA

South Carolina: 1954. Hdqrs., Columbia. PRES, J. E. McMurray, 1639 Blanding St. SECY, A. L. Blackstone, Jr., 1630 Laurel St.

TENNESSEE

Memphis: 1944. Hdqrs., Memphis. Meets, 3rd Mon. PRES, W. L. Henson, 496 S. Main St. SECY, G. B. Ramsey, Jr., 157 Neil St. (3).

TEXAS

Austin: 1956. Hdqrs., Austin. PRES, B. E. Segall, Jr., 705 N. Lamar. SECY, J. L. Rez Jr., 300 W. 8th St., P.O. Box 5206.

El Paso: 1956. Hdqrs., El Paso. PRES, J. O. LeBeau, Jr., 1021½ E. Missouri. SECY, J. H. Brooks, 4028 Hamilton St.

North Texas: 1936. Hdqrs., Dallas. Meets, 3rd Mon. PRES, H. G. Gregerson, 4512 Livingston (5). SECY, Ross Zumwalt, 929 Mercantile Securities Bldg. (1).

South Texas: 1938. Hdqrs., Houston. Meets, 3rd Fri. PRES, J. C. Lewis, Box 8188. SECY, E. B. Appling, 4101 San Jacinto St. (4).

Southwest Texas: 1946. Hdqrs., San Antonio. Meets 3rd Tues. PRES, Boone Crisp, Rt. 2, Box 421. SECY, D. T. Kern, 14 Chandler Bldg. (5).

West Texas: 1953. Hdqrs., Lubbock. Meets, 1st Tues. PRES, J. C. Wharton, P. O. Box 1240. SECY, D. G. Halley, 3606 Ave. A.

UTAH

Utah: 1944. Hdqrs., Salt Lake City. Meets, 3rd Thurs. PRES, W. L. Stuewe, 1472 S. State St. (4). SECY, W. C. Leslie, 307 W. 2nd St.

VIRGINIA

Virginia: 1946. Hdqrs., Norfolk. Meets, 3rd Wed. PRES, C. G. Conaway, Jr., 7454 Hanc Ave. (5). SECY, E. R. Simpson, Jr., 720 Guy St.

WASHINGTON

Inland Empire: 1956. Hdqrs., Spokane. Meets, 1st Mon. PRES, Max Tonn, 4021 S. Laiawah. SECY, R. D. Nevers, E. 124 Augusta, P.O. Box 5026 (21).

Pacific Northwest: 1928. Hdqrs., Seattle. Meets, 2nd Tues. PRES, L. F. Christofferson, 425-1411 Fourth Ave. Bldg. (1). SECY, H. M. Hendrickson, Mech. Engrg. Dept., University of Washington (5).

WISCONSIN

Wisconsin: 1922. Hdqrs., Milwaukee. Meets, 3rd Mon. PRES, H. K. Fortar, 1400 E. Park Pl. (11). SECY, H. W. Snyder, 5550 W. Burleigh (10).

CANADA

British Columbia: 1932. Hdqrs., Vancouver. Meets, 2nd Wed. PRES, D. M. Thomson, 696 W. Broadway (9). SECY, W. F. Keenan, 54 W. Fifth Ave. (10).

Manitoba: 1935. Hdqrs., Winnipeg. Meets, 4th Thurs. PRES, A. H. Miller, 342 Mandeville St. (12). SECY, R. M. Fraser, 1855 Sargent Ave. (12).

Montreal: 1936. Hdqrs., Montreal. Meets, 3rd Mon. PRES, S. R. Piamondon, City Planning Dept., Smoke Control Division, City Hall. SECY, Arthur DeBreyne, 9 St. Denis St., St. Lambert.

Northern Alberta: 1956. Hdqrs., Edmonton. Meets, 3rd Wed. PRES, W. C. Woods, 13908 116 Ave. SECY, E. K. Cumming, 10249 104 St.

Ontario: 1922. Hdqrs., Toronto. Meets, 1st Mon. PRES, C. J. Bootes, 15 Torbarrie Rd., Downsview. SECY, H. R. Roth, Rm. 407, 57 Bloor St., W.

Ottawa Valley: 1952. Hdqrs., Ottawa. Meets, 3rd Tues. PRES, D. W. Banton, 360 Richmond Rd. (3). SECY, Jacob Klassen, 454 Sister St. (4).

SPECIAL BRANCH

Switzerland: 1952. Hdqrs., Zurich. PRES, Walter Hausler, Erbstrasse 2, Kusnacht. SECY, L. F. de Bruyn, Heschgasse 45.

STUDENT BRANCHES

North Carolina State College: 1948. Faculty Adviser: Prof. R. B. Knight, M. E. Dept., Raleigh, N. C.

Oregon State College: 1949. Faculty Adviser: Prof. G. E. Thornburgh, M. E. Dept., Corvallis, Ore.

Purdue University: 1948. Faculty Adviser: Prof. F. B. Morse, M. E. Dept., West Lafayette, Ind.

Texas A. & M. College: 1946. Faculty Adviser: Prof. L. S. O'Bannon, M. E. Dept., College Station, Tex.

University of Detroit: 1949. Faculty Adviser: Prof. J. E. Lay, M. E. Dept., Detroit, Mich.

University of Toronto: 1951. Faculty Adviser: Prof. F. G. Ewens, M. E. Dept., Toronto, Ont., Canada.

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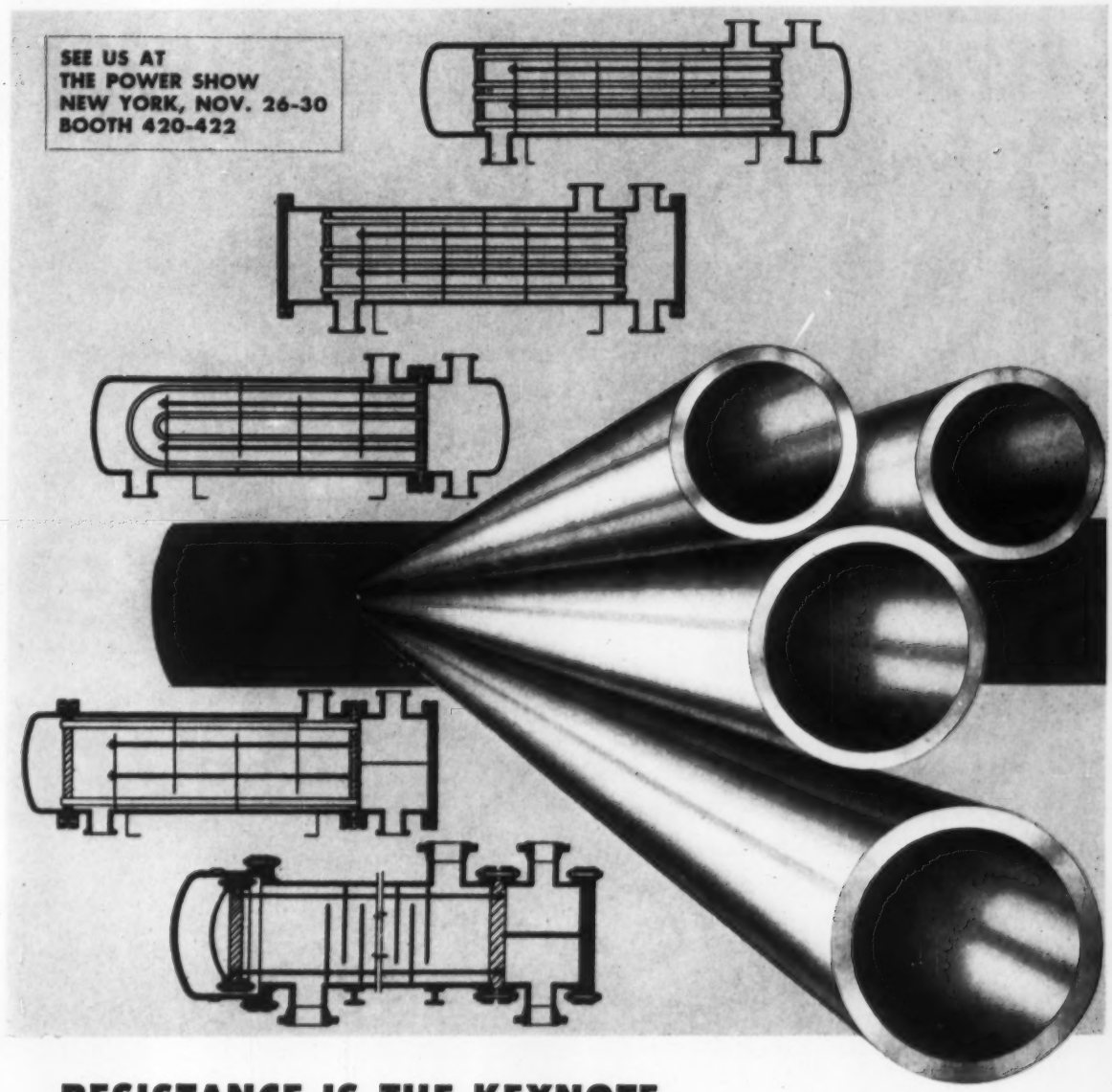

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YORK "FOOT-HIGH" room units give architects, builders more freedom in room design, construction.

YORK PRIOR PLANNING SERVICE aids architects when designing air conditioning systems to fit the job

- Saddling an architect with a bulky air conditioning unit makes his task harder, forces him to compromise designs.
- York provides Air Conditioning systems to fit the job, giving architects a freer hand to develop their designs along truly functional lines.
- The new "foot-high" York induction unit typifies York advances in meeting today's requests of architects and consulting engineers for smaller, more compact, more attractive systems.

PRIOR PLANNING SERVICE is the name York gives to its program of working with your architect, consulting engineer, builder, and you – from the very first planning stage until your complete air conditioning system is installed and operating. One of the big reasons that York can offer such a valuable complete service is the variety and ingenuity of York equipment designs. York builds the system to fit the building.

New Unit design gives architects more freedom of room design. The new York "foot-high" air conditioning unit shown at the left is a good example of York's ability to meet difficult specifications. Only twelve inches high, this unique unit is designed to allow architects to specify full length windows. Offices using a YORK system with the new "foot-high" room units will seem – and be – more spacious, lighter, and yet just as comfortably cooled and ventilated as they are with other type York Units.

York equipment allows for special building designs and room arrangement. Out of sight, other York developments aid the architect and builder. Powerful York Turbomatic compressors, for example, are light enough to be mounted on high floors, without expensive structural changes; and they are smaller, too, leaving more rentable space.

York's PRIOR PLANNING SERVICE depends upon the superior engineering ability of the carefully trained York sales engineer. This York sales engineer can be one of your most valuable aides when planning your air conditioning. Call him early in your planning or write York Corporation, subsidiary of Borg-Warner Corporation, York, Pennsylvania.

York refrigeration air conditioning

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HEADQUARTERS FOR MECHANICAL COOLING SINCE 1885

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SPECIALISTS IN PIPE SUPPORTS

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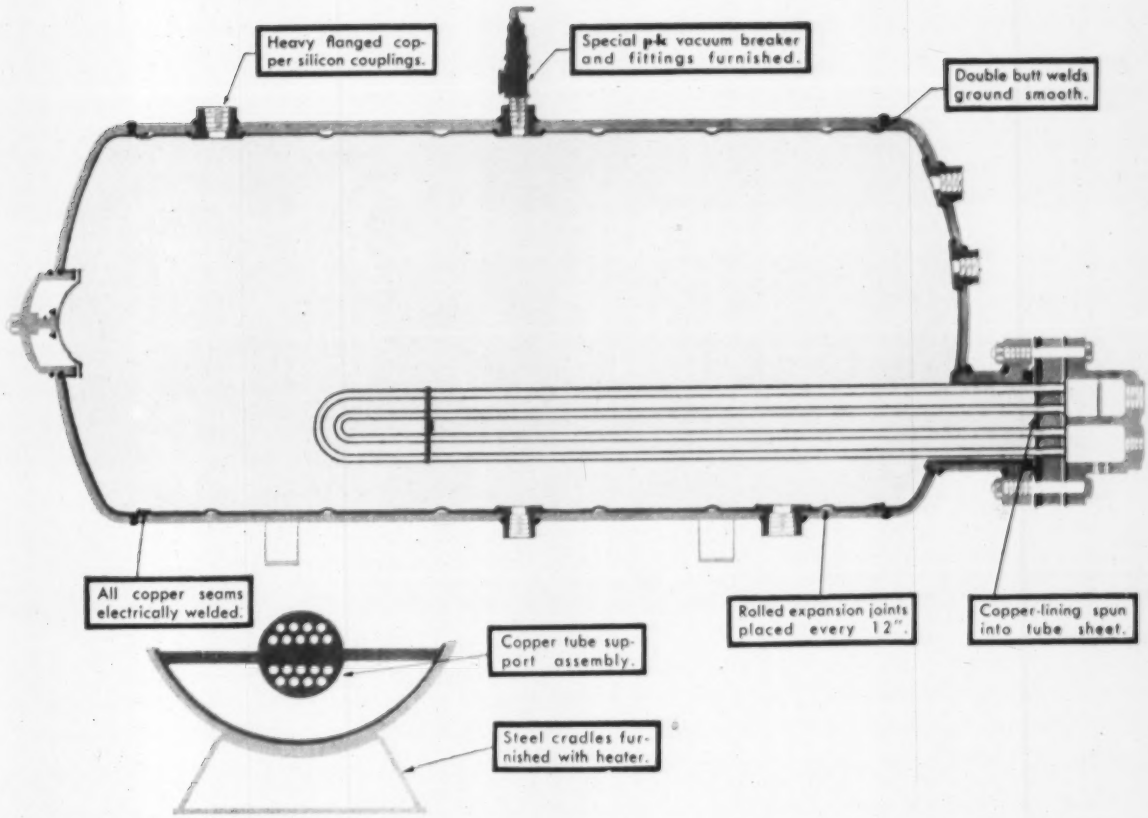
Heavy flanged copper silicon couplings.
Special p-k vacuum breaker and fittings furnished.
Double butt welds ground smooth.
All copper seams electrically welded.
Copper tube support assembly.
Steel cradles furnished with heater.
Rolled expansion joints placed every 12".
Copper-lining spun into tube sheet.

WHAT TO LOOK FOR IN A *Copper-Lined* HEATER

Nearly everyone knows the advantages of a copper-lined heater. Few realize the importance of the design features that are essential to long life and trouble-free service.

When you have manufactured a quality product for more than 40 years... built more than any other fabricator... and have thousands of successful installations from coast to coast, you know that product: how to build it *right* . . . economically . . . and with every possible design feature that 40 years experience shows is necessary.

Some of **p-k**'s experience is indicated in the diagram above. In the lining of this **p-k** heater, for instance, rolled joints are used at regular intervals around the full circumference, to allow for longitudinal expansion. Heavy flanged copper silicon couplings are securely welded to both the shell and the lining.

Standard equipment includes a special **p-k** vacuum breaker to protect the lining from sudden pressure fluctuation.

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Experienced engineers know these points are critical. They know, too, that there is no substitute for this painstaking **p-k** type of construction . . . and that *insisting on* and *specifying* these construction points in copper-lined heaters justifies itself over and over again.

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"Janitrol equipment has been in use here for many years. 400 units have been proved in service . . . we've standardized on Janitrol." S. P. Robertson, Chief Industrial Engineer, Reed Roller Bit Co., Houston, Texas.

"To cut costs but not performance—we specified Janitrol. The same ducts and blowers are used for both heating and cooling, in 80% of VanAken Center Stores." Milton A. Wolf, Partner, Zehman-Wolf Construction Co., Cleveland, Ohio.

"Janitrol engineering made 10 units do the job of 15 . . . saved 1/3 on equipment investment." H. M. Watkins, Manager, Layne-Bowler Pump Co., Montebello, California.

"Our Janitrol unit heaters save up to 40% in fuel costs." J. C. Mayle, President, Fremont Tool & Die Co., Fremont, Ohio.

"Shopping center designers boast trouble-free service, high efficiency and minimum maintenance after 12 years' experience with Janitrol units." Irving Berger, Berger-Tilles Projects, Levittown, L. I., New York.

"We replaced our central steam system with Janitrol unit heaters. Outside of usual maintenance, we have had no service costs." D. M. Blair, Plant Supt., Blair Aluminum Furniture Co., Marietta, Georgia.

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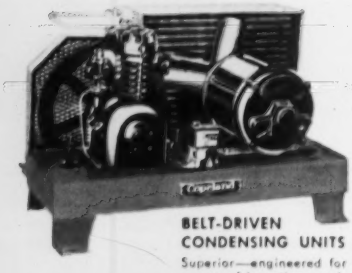

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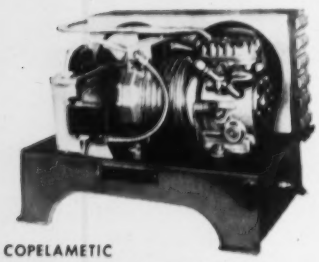

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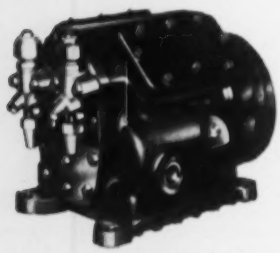

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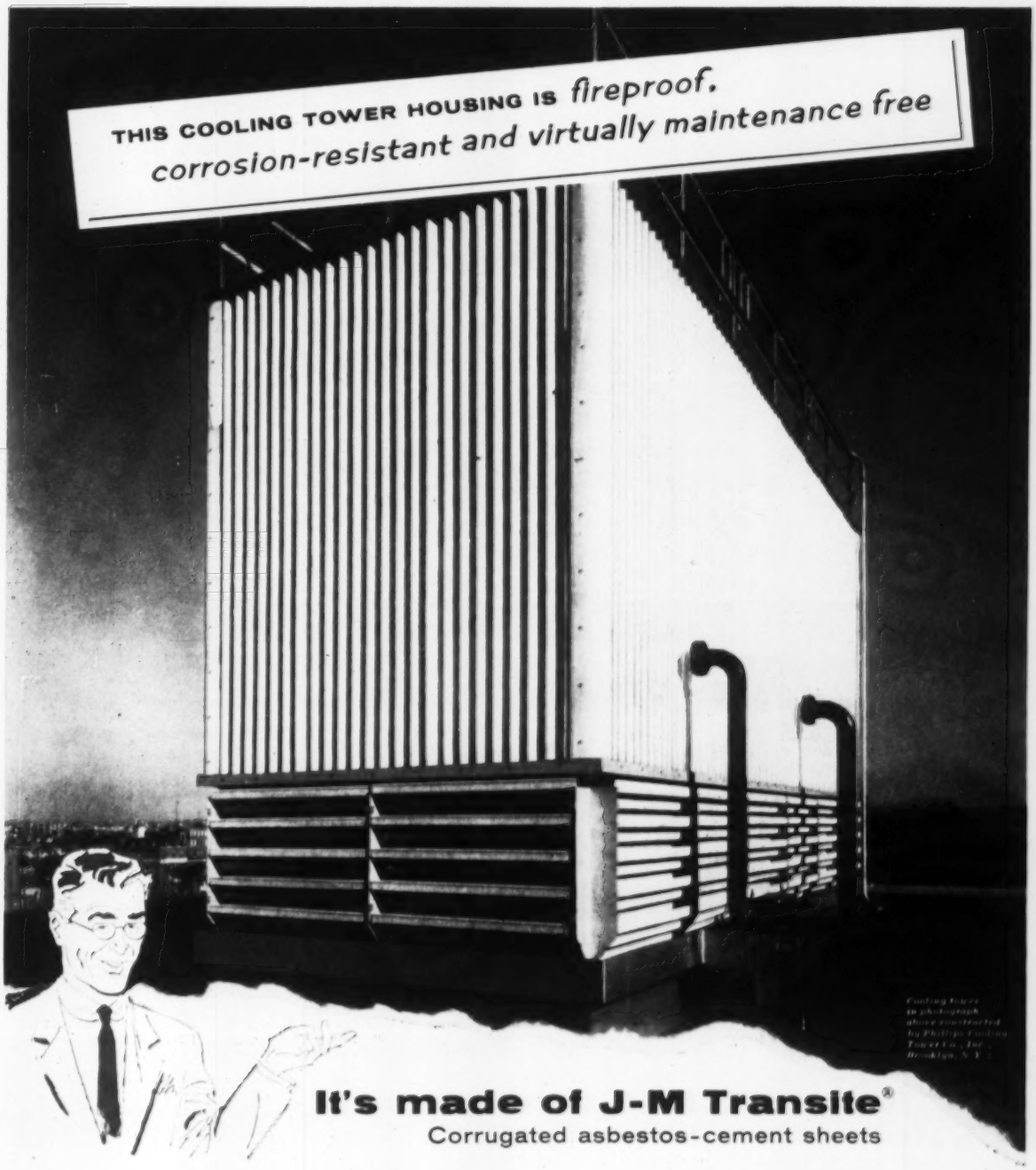

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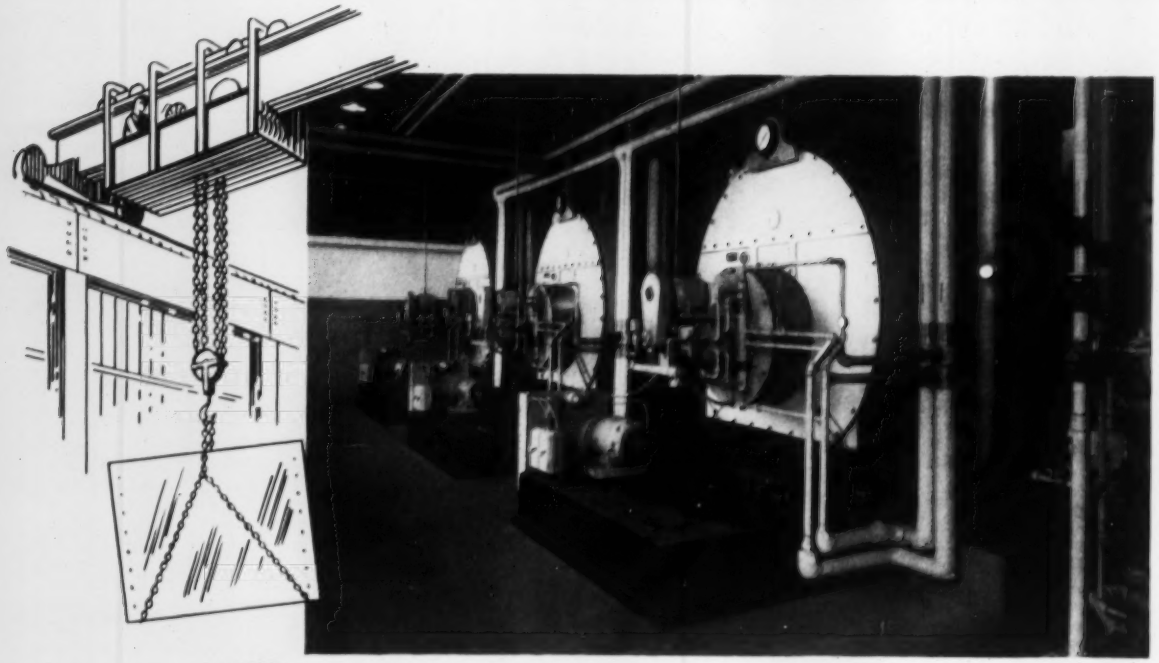

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Bigger, heavier and more ruggedly designed, Superior Steam Generators are integrated engineered so that all components are matched in size and function to one another.

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5 sq. ft. of heating surface per b.h.p. . . . induced down-draft design . . . sized to capacity boiler shells . . . for longer life at high efficiency.

FACTORY FIRE TESTED
Completely fire tested before shipment . . . adjusted to peak performance, and guaranteed on the basis of these actual tests.

SHIPPED COMPLETE
Set it on any floor capable of supporting its weight; tie into fuel, steam and electric lines, and you are ready to start producing steam . . . efficiently and economically.

STARTED ON THE JOB BY FACTORY TRAINED EXPERTS
Superior responsibility ships with the boiler in the form of a factory trained expert, on hand to start the boiler, to adjust it on the job to peak performance, and to instruct operating personnel.

Because Superior Steam Generators are complete packages, designed, engineered and built by Superior Combustion Industries, Inc., they are backed by undivided responsibility . . . responsibility that goes beyond manufacture, and includes factory fire testing before shipment, and factory trained personnel at the installation point to start the boiler initially, adjust it to peak performance, and to advise the operating engineer on how to get the most out of the unit.

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18 sizes from 20 to 600 b.h.p. for pressures up to 250 p.s.i. or for hot water. For complete details, write for Catalog 804.

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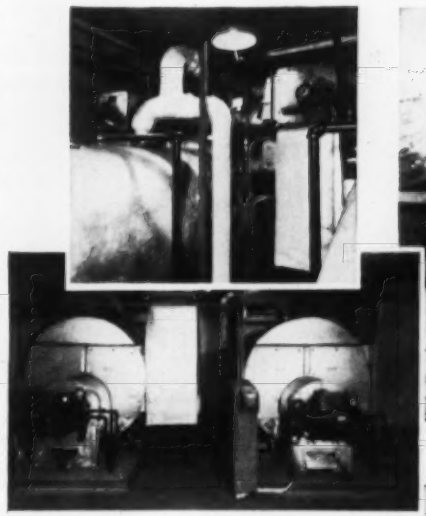
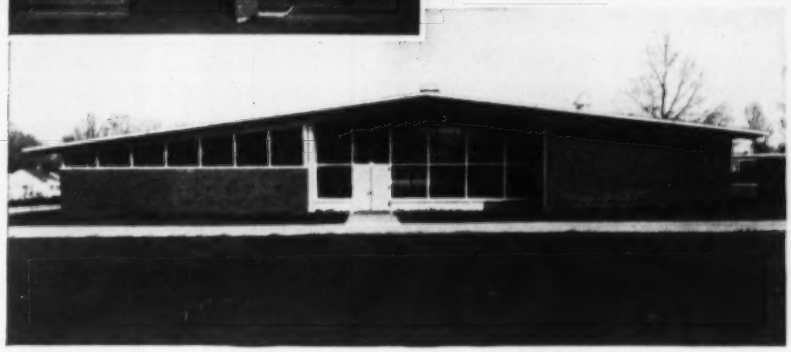
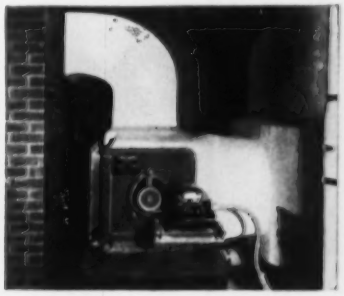


(Above) Stouffer's Restaurant, Wynnewood, Pa., one of a famous chain of quality restaurants. (Left) Detail of two scotch boilers at Stouffer's, each equipped with a Wing Draft Inducer.



HOWELL LEWIS SHAY, INC., ARCHITECTS

WOLFSON AND SCHNOLL, INC., CONSULTING ENGINEERS



(Left) Berwyn School, Berwyn, Pa. (Above) Wing Draft Inducer installed in heating boiler at Berwyn School.

Today it is unnecessary to mar modern, low, horizontal building lines with tall chimneys in order to provide boiler draft. Wing Draft Inducers, installed in boiler breechings, assure positive, adequate draft regardless of wind, weather or load variations. Yet, the only chimney necessary is a stub stack, just clearing the roof, for venting gases.

This means savings in original building costs and future stack maintenance expense. Furthermore, a big cut is made in fuel costs because of the complete combustion you get with Wing Draft Inducers.

Write for Bulletin I-56 for complete details.

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WING TURBINES

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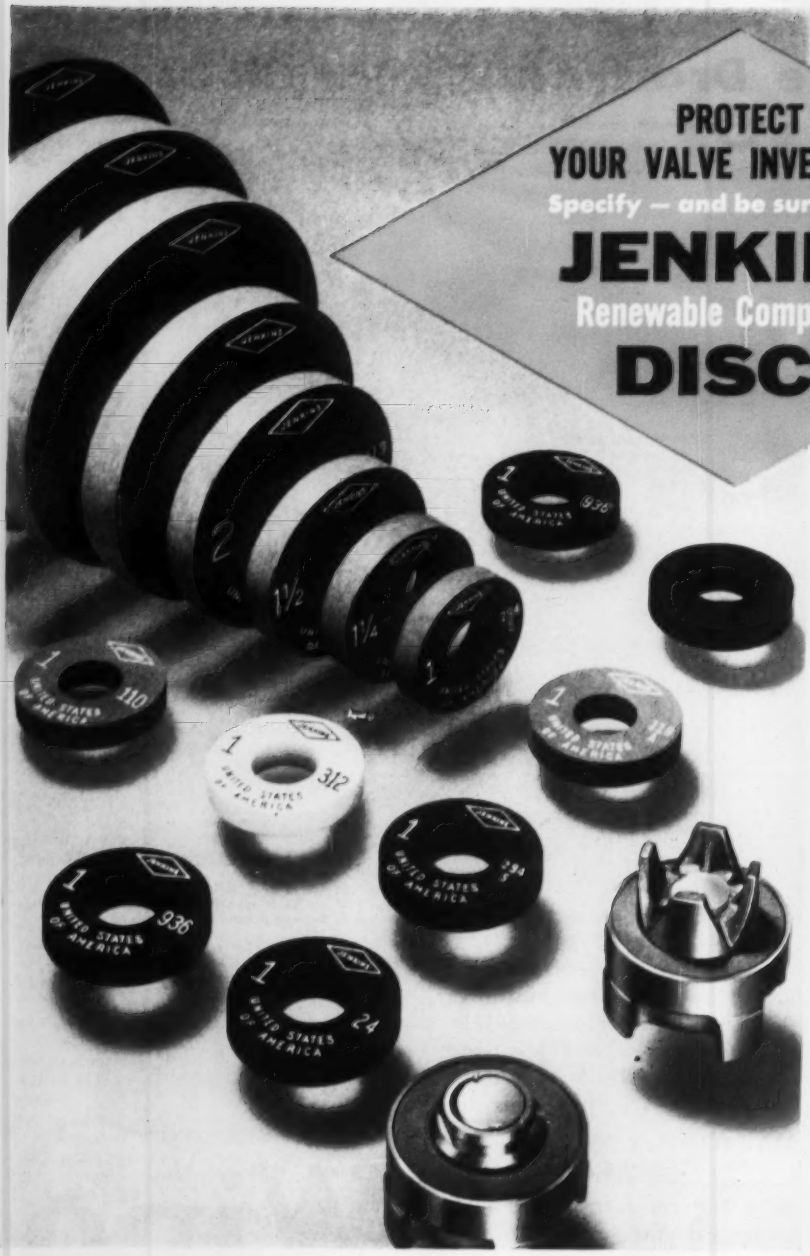

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Specify — and be sure you get

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MADE BY THE ORIGINATORS OF RENEWABLE DISC VALVES

Jenkins Bros. has remained the leader in composition disc development and production since 1864, when the first renewable disc valve was introduced.

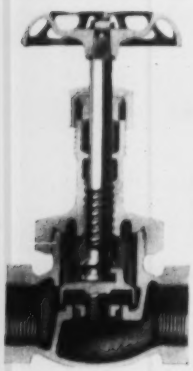
THE ONLY MANUFACTURER OF BOTH VALVES AND DISCS

Jenkins Bros. devotes continuous laboratory and field research to disc improvement through use of new compounds, and new production techniques.

NEW GUIDE FOR DISC SELECTION

Describes all Jenkins Discs, and their applications for steam, hot and cold water, air, gas, oil, gasoline . . . including the new TEFLON® DISC for lasting, dependable control of oxygen and other gases, solvents, acids, alkalies, and other chemicals,—and for liquid food and similar services.

Ask your Jenkins Valve Distributor for Disc Folder Form 203, or write: Jenkins Bros., 100 Park Ave., New York 17.



. . . for highest efficiency, use the time-proved combination . . . JENKINS DISCS in

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Order from Your Local Jenkins Distributor

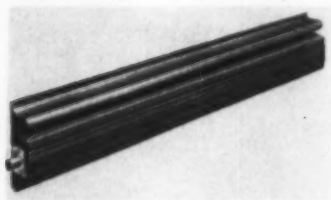
EQUIPMENT DEVELOPMENTS . . .

For reviews of Recent Trade Literature see Page 236

15 Hp Air Conditioner . . .

. . .in 1957 packaged model for commercial application—*York Corp., Dept. HPAC, York, Pa.*

"Yorkaire" unit recommended by company for installation in shopping centers, supermarkets, hotels, office buildings. Multiple refrigeration systems designed to provide maximum control of humidity, temperature. Step-control provided to match output to needs of space. For applications requiring ductwork but with low head room, rotating fan section permits fans to be turned forward to throw air directly into front mounted supply duct.



Baseboard . . .

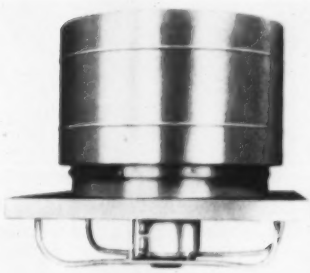
. . .with cam-lock feature for removal of front—*Spartan Convector Co., Inc., Dept. HPAC, 52-55 74th St., Maspeth 78, N.Y.*

Other cited features include: universal damper that holds to any desired position; floating coil that eliminates noise when coils expand or contract. Design is free of sharp corners.

Pipe Welding Electrode . . .

. . .designed for all-position use—*Lincoln Electric Co., Dept. HPAC, 22801 St. Clair Ave., Cleveland 17.*

Suitable for all E-6010 applications, but especially designed for pipe welding, says company. Cited features are smooth arc operation, deep penetration, good bead wash-in. Also, is said to provide minimum slag interference, resulting in quick freezing of molten metal, less tendency for "windows" and porosity. In $\frac{1}{8}$ and 5/32 in. diameters.



Roof Ventilator . . .

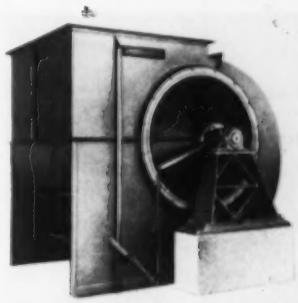
. . .with "automatic" damper blades—*Chicago Blower Corp., Dept. HPAC, 9363 Pacific Ave., Franklin Park, Ill.*

Aluminum blades pivot on bearings across diameter of fan to open wide with minimum fan pressure, says company. When operating, exhaust velocity keeps out rain, snow, exhaust reentry. Blade diameters range 24 to 60 in. with exhaust capacities 6640 to 53,700 cfm.

Modification Kits . . .

. . .for on-the-spot modification of company's line of magnetic starters—*General Electric Co., Dept. HPAC, Schenectady 5, N. Y.*

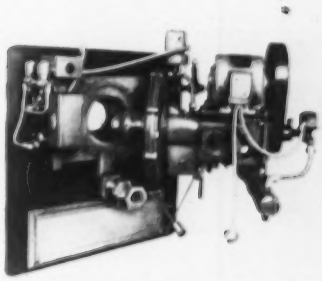
Six different kits designed for across-the-line nonreversing, combination, or reversing starters. Modification made by installing push-button or selector switch in starter cover, changing fuse clips on disconnect switch, changing coil, adding a third overload relay, or adding auxiliary interlock kit.



Centrifugal Fans . . .

. . .for heavy duty industrial applications—*American Blower Corp., Dept. HPAC, Detroit 32.*

"Airfoil" units available with single, double inlet construction in sizes for volumes to 1 million cfm. Blade design plus improved design of streamlined inlets, wheel rims, housing are said to contribute to high efficiency.



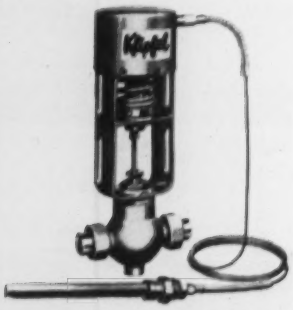
Gas/Oil Burner . . .

. . .in 12 size ranges 1 to 200 gph oil, 600 to 30,000 cfh gas—*Enterprise Engine & Machinery Co., Dept. HPAC, 13th and Florida Sts., San Francisco 10.*

Features spudless gas ring recessed inside cast iron nozzle protector. Construction is said to permit quick, easy installation from outside furnace. With converging nozzle protector acting as form for refractory materials, burner may also be removed from outside furnace without disturbing firebox lining.

EQUIPMENT DEVELOPMENTS

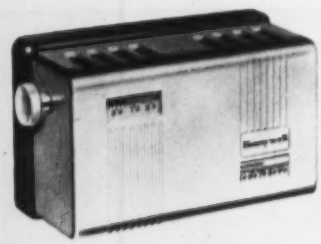
Continued



Temperature Regulator . . .

. . .designed to provide accurate, positive control for installations where danger of overheating, product spoilage, equipment damage is present—*Klipfel Valves, Inc., Dept. HPAC, Hamilton, Ohio.*

Self actuated vapor pressure type unit recommended by company for control of hot water tanks, instantaneous heaters, steam tables. Components are "extra powerful" bellows actuator connected by capillary tubing to temperature sensitive bulb. Actuator is mounted on top of yoke connected to valve. Bellows supplies power for controlling valve opening in response to temperature changes at bulb.



Thermostats . . .

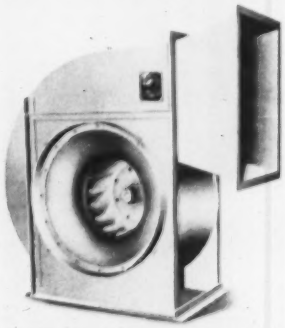
. . .engineered to take hot "peaks," cold "valleys" out of electric heating—*Minneapolis-Honeywell Regulator Co., Dept. HPAC,* 2641 *Fourth Ave., S., Minneapolis* 8.

In two models: one designed for low-mass, quick heating-quick cooling units; other recommended by company for large-mass, slow heating-slow cooling systems such as used in ceiling and floor cable heating applications. Both operate without supplemental relays, transformers.

Welding Rods . . .

. . .for braze welding and welding malleable iron, cast iron, brass, bronze with dirty, oily or greasy surfaces—*Air Reduction Sales Co., Div. of Air Reduction Co., Inc., Dept. HPAC,* 150 *E.* 42*nd St., New York* 17.

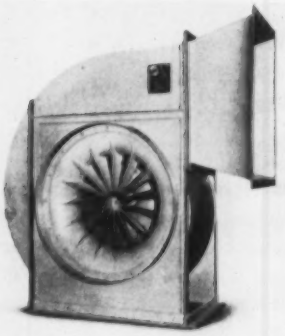
Three types available: "No. 20" bronze rod for general braze welding, welding; "No 22" manganese bronze rod designed for high strength welds; "No. 27" low fuming bronze rod. In diameters 1/8, 3/16, 1/4, 3/32 in.



Radial Wheel Fan . . .

. . .for high volume, high pressure applications—*Buffalo Forge Co., Dept. HPAC,* 171 *Mortimer St., Buffalo* 5.

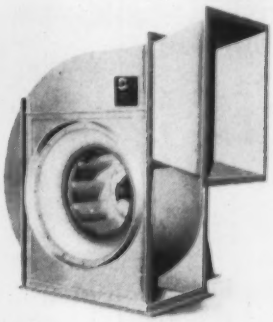
"CR" unit is said to offer high mechanical efficiency over broad range, to be also suitable for handling dust laden air. Characteristics are result of inlet-to-outlet streamlining, new radial blade design, says company.



Fans . . .

. . .designed for high efficiency on high pressure ventilation, air conditioning, mechanical draft—*Buffalo Forge Co., Dept. HPAC,* 171 *Mortimer St., Buffalo* 5.

Inlet retains same inlet bell used in company's "Type BL" fan, but with further streamlining of curved inlet guide vanes, says manufacturer. These are cantilevered, with no center ring to cause turbulence. Variable vanes can be substituted. Available in wheel diameters 18½ to 80¾ in.



Airfoil Blade Fans . . .

. . .added to company lines of radial wheel, backward curved types—*Buffalo Forge Co., Dept. HPAC,* 171 *Mortimer St., Buffalo* 5.

Recommended by company for forced draft, industrial air moving service. Airfoil blades internally strutted. Broadness of blades at point where air enters wheel is said to provide very deep bite of entering air. Channels between blades designed to form smoothly diverging passages for efficient flow, stability.

Butterfly Valves . . .

. . .designed to shut off against low pressure or vacuum as well as full line pressure for which it is rated—*Keystone Valve Corp., Dept. HPAC,* 5325 *Kirby Dr., Houston* 5.

Cited feature is perfect closing action facilitated by resilient seat firm-

These are important problems! DO YOU KNOW THE ANSWERS?

1. **Does BRONZE or ALUMINUM paint on an IRON radiator improve or impair its performance?** (19, 20, 22)

2. **Will ORDINARY paint on an IRON radiator improve or impair its performance?** (19, 20, 22)

3. **Is it true that ICE radiates heat at a greater rate than a stove?** (17, 18, 22)

4. **What is :- *k* factor? C factor? Btu? U factor? R factor?** (17)

5. **Is it true that the loss of each lb. of vapor represents a heat loss of 1060 Btu's, or TEN TIMES that which raises the temperature of 1 lb. of water 100°F?** (5)

6. **Does insulation KEEP OUT THE COLD?** (17, 3)

7. **Do thermal insulations create heat?** (3)

8. **Is it desirable to place vapor barriers on both sides of an insulation?** (5)

9. **Is it true that cold does not flow to warm, but heat to cold?** (17, 18, 19)

Alexander Schwartz, writer and lecturer on heat flow, vapor flow, and condensation.

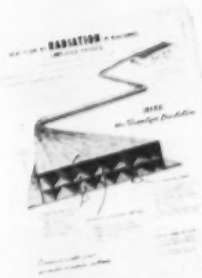
Some of the answers may surprise you! Look them up in a handy, *new* reference manual, "Heat Flow by Radiation in Buildings," by Alexander Schwartz. You may obtain the booklet *free!*

The numbers above refer to pages in this *important contribution* on the theory and practice of insulating against heat and vapor flow, and against destructive condensation. It is replete with simple, illustrated explanations of how to solve many usual and unusual heat flow and fuel problems; also illustrates many new installation techniques.

The author is a well-known lecturer in the field of heat and vapor flow, and thermal insulation. He is president of Infra Insulation, Inc. and author of "Simplified Physics of Vapor and Thermal Insulation," which has been used for years as a text in universities, technological institutes and colleges, and as a valuable reference by architects, engineers, and builders.

In this one handy booklet of 48 pages are assembled and presented in clear, concise, easy-to-follow language: – facts; figures; reports of practical experiments and scientific theories obtainable otherwise only through years of study and consultation of hundreds of books and other publications. It is generously illustrated with drawings, photographs, diagrams, charts.

"Heat Flow by Radiation in Buildings" is yours, FREE, for the asking —Just use the coupon, and get the "answers"!



Infra Insulation, Inc., 525 Bway., N. Y., N. Y. H-11

Please send ☐ Heat Flow by Radiation

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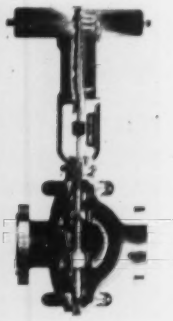
EQUIPMENT DEVELOPMENTS
Continued

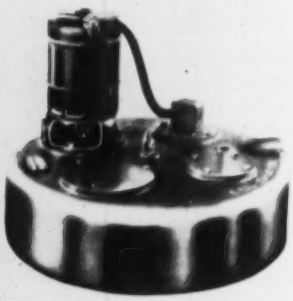
ly held inside specially constructed narrow ring, says company. Resilient seat is under compression, effecting seal at both points where stem passes through it and around periphery of disc.



Diaphragm Valves . . .

. . . with new topworks, redesigned valve body, all metal float ring seal—*Black, Sivalls & Bryson, Inc., Dept. HPAC, 7500 E. 12th St., Kansas City 26, Mo.*

Topworks features molded diaphragm designed for uniform thrust over full valve travel; pressed steel cases for maximum strength, minimum weight. Valve bodies are said to have streamlined contours, new top and bottom guided inner valves. Bodies available in single port, double port, split body styles.



Pump . . .

. . . with 25 gal cast iron receiver—*Weil Pump Co., Dept. HPAC, 1520 N. Fremont St., Chicago 22.*

Cited features are low return inlet, slow speed motor. Pump is all bronze, shaft is stainless steel. Motors are ½ to 1 hp, 1750 rpm. Installation requires two piping connections: return, discharge.

Valve

. . . for pressure reducing, relief for air, gas, oil, water pressure—*Atlas Valve Co., Dept. HPAC, 280 South St., Newark 5.*

Operates on initial pressures to 1000 psi. Features adjustable control pressures that can vary up or down by as little as 2 psi over range as wide as 0-2500 psi, says company. Single seated, spring loaded, diaphragm actuated.

Power Pack . . .

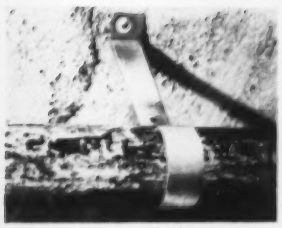
. . . for use with electrostatic air filters in room coolers—*General Electric Co., Dept. HPAC, Schenectady 5, N. Y.*

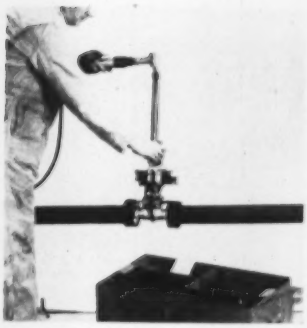
Combination designed to remove dust, grime, soot, smoke, lint, pollen. Power pack builds up electric charge on filter, opposite charge on dust and pollen particles in air. Operates on 115 or 230 volts, 60 cycles.

Masonry Anchor . . .

. . . with one-piece design—*Star Expansion Bolt Co., Dept. HPAC, 142 Liberty St., New York 6.*

Engineered for faster, more convenient fastening. Fastened by driving pin protruding from head. Recommended by company for permanent anchoring of pipe clamps to concrete ceilings, other masonry surfaces, as shown.

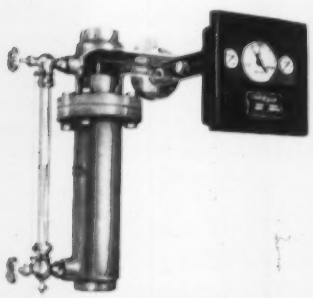




Power Tool . . .

. . . designed save on labor and fuel, increase production—*Leavitt Machine Co., Dept. HPAC, 10 East River St., Orange, Mass.*

One man using new motor driven valve reseating grinder can regrind any globe or gate valve ¼ to 12 in. without removing valve from line, says company.

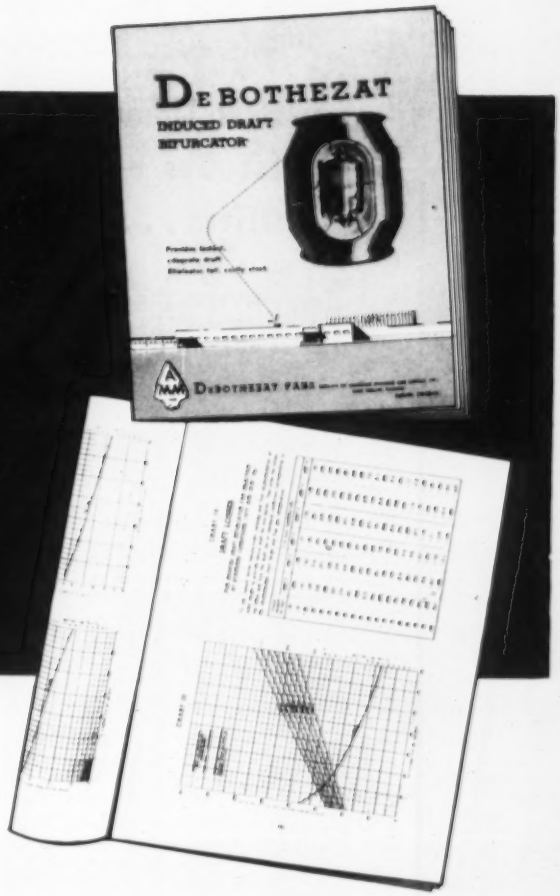


Level Controller . . .

. . . with displacement type operation, redesigned without bearings, knife edges—*Kieley & Mueller, Inc., Dept. HPAC, Middletown, N.Y.*

"Flexotrol" has torque table which replaces pivoting members. Face of torque table, engaging and driving

NEW DeBOTHEZAT INDUCED DRAFT BIFURCATOR® CATALOG



all boiler code ratings expressed in BTU/HR

A valuable working tool for both the engineer and contractor. This new 20-page catalog gives all manufacturers' organizations boiler code ratings reduced to their common relationship of BTU/HR delivered to the steam.

Also included are useful tables and charts on volume of flue gas for oil, gas and coal. Facts are given on the selection, use and installation of Induced Draft Bifurcator Fans. Performance data and complete specifications on all DeBothezat Induced Draft Bifurcators are outlined in detail.

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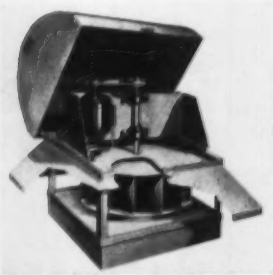
EQUIPMENT DEVELOPMENTS

Continued

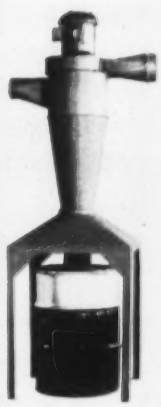
torque tube, is free to twist under action of displacer. Units available with external displacer chambers or in models for direct displacer immersion in process vessel.



Centrifugal Ventilators . . .

. . .in two new models designed for high efficiency, quiet operation at slow speeds—*Burt Mfg. Co., Dept. HPAC, Akron* 11.

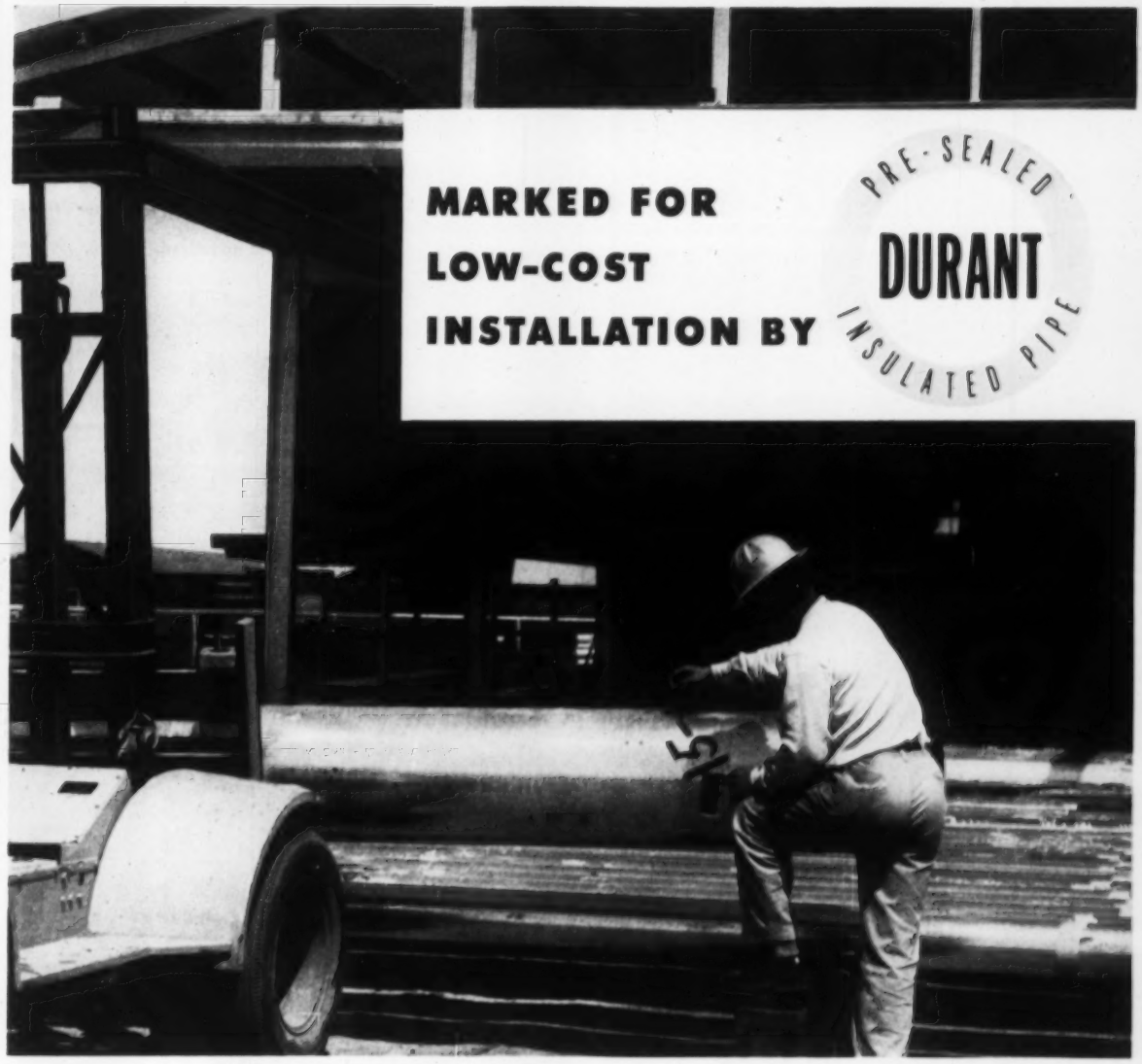
Recommended by company for use in schools, hospitals, dormitories, institutions, arenas and commercial, industrial applications where low noise levels desirable. "Centriflow" units available with v-belt drive for capacities 675 to 36,430 cfm, and in low profile model of spun aluminum for capacities 408 to 2508 cfm.



Dust Collectors . . .

. . .with connections to standard 55 gal drums—*Torit Mfg. Co., Dept. HPAC,* 287 *Walnut St., St. Paul* 2.

Cyclone type units recommended by company for use in installations where large volumes of bulky, sticky dust are created. Exhausting capac-



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Taking the guesswork out of installations is just one way D.I.P. helps you achieve lower original costs on insulated underground piping contracts.

Pre-insulated at the factory, and prefabricated in standard increments, D.I.P. conduit requires only direct top-position pipe welds and simple field joints. No special masonry, underground supports, backfills or sub-drains.

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*Trademark

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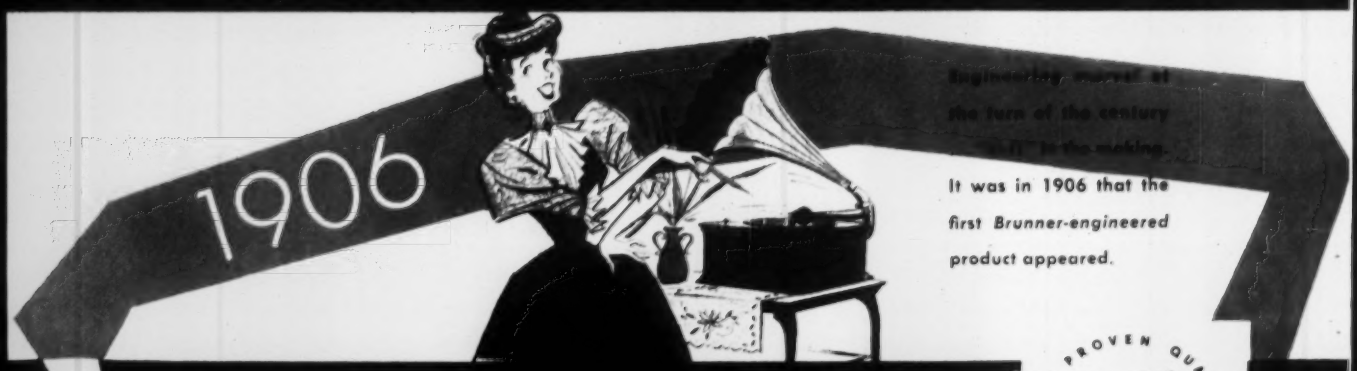


It was in 1906 that the first *Brunner-engineered* product appeared.

PROVEN QUALITY
50th Anniversary
BRUNNER
SINCE 1906
DEPENDABLE

TODAY... Brunner experience pays off in more sales for you...

provides the most complete line of Air Conditioning Condensing Units available from a single source!

There's a right Brunner Condensing Unit for every remote Air Conditioning application . . . ranging from ¼ H.P. through 100 H.P.

ALSO AVAILABLE

Newly designed BAC packaged units in 3, 5, 7½ and 10 H.P., finished in Hammertone Green.

EQUIPMENT DEVELOPMENTS

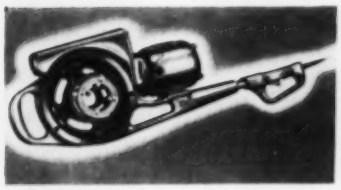
Continued

ities range 1000 to 1100 cfm of air at speeds in excess of a mile a minute, manufacturer reports. Collectors feed directly into drums which can be removed, replaced when full.

Gas Valve . . .

. . .designed to reduce explosion hazards in boiler firing—*Maxon Premix Burner Co., Dept. HPAC, Muncie, Ind.*

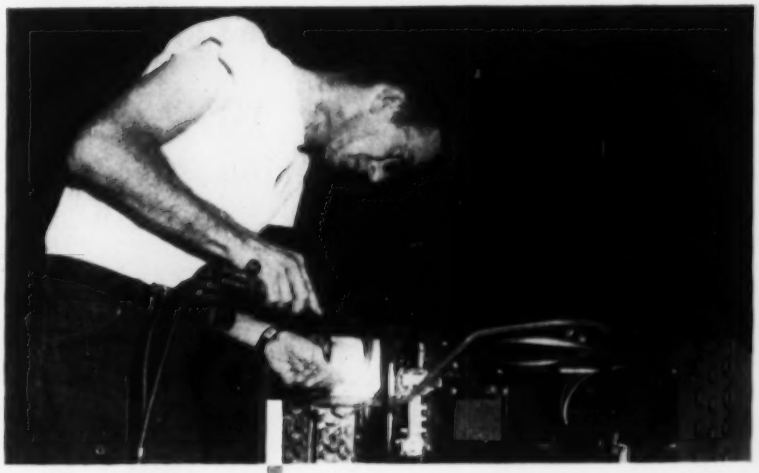
Cited features are: dual release mechanism that provides double safeguard against mechanical failure, both mechanisms operating simultaneously and each causing valve to close if electric safety circuit interrupted; heavy transmission and bearings, oil immersed to facilitate many operations without maintenance; "shearing-action" body design to provide self cleaning of valve disc. In sizes 1 to 6 in.



Power Drive . . .

. . .for pulling, lifting, threading, turning on variety of jobs—*Toledo Pipe Threading Machine Co., Dept. HPAC,* 1445 *Summit St., Toledo* 4.

Redesigned unit has streamlined frame, is slightly heavier and more sturdy, says company. New ball bearing design is said to improve service



important announcement to *United* brazing customers

If you are presently using United Phoson 15 alloy (government grade III) this is notification that a switch to Phoson 6, the most talked about brazing alloy in the country, will cut your costs at least 30 per cent with *equal performance* in every respect.

Extensive field tests—eight years of them—have proven Phoson 6 best for brazing copper and brass. Most of United's customers, 80 per cent, in fact, have already changed.

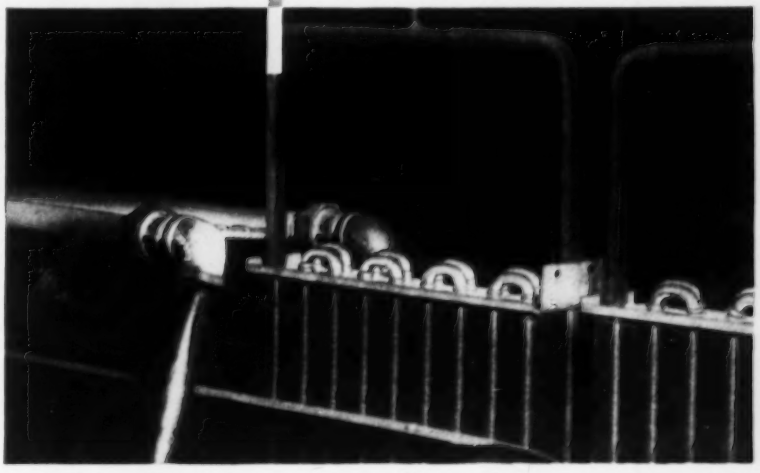
here's the story!

Silver 6%	Brazing Temperature 1300°
Copper 87¾%	Original Tensile 92,000 PSI
Phosphorous 6¼%	Rockwell 15T 86
AWS BCuP 3	

Write for the facts today.

UNITED WIRE AND SUPPLY CORPORATION

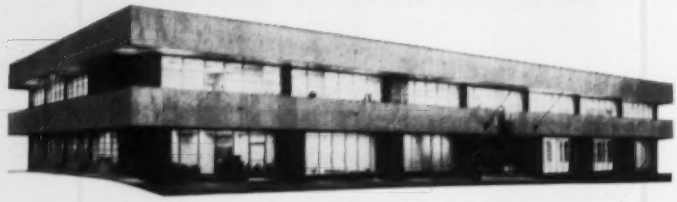
PROVIDENCE 7, RHODE ISLAND



In the new Dallas Insurance Center . . .

Flexible *Thermaflex*®

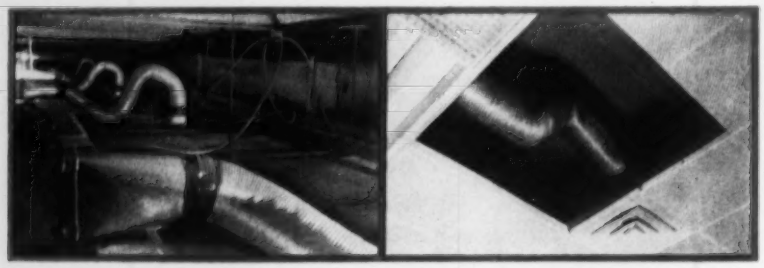
keeps floor plans flexible, too!



George L. Dahl, Architects & Engineers; O'Rourke Construction Co., General Contractor; United American Insurance Co., Owner—all of Dallas

Rigid ducting couldn't handle this job!

To allow for future rearrangement of offices, ceiling diffusers in the new Dallas Insurance Center had to be readily moveable! They are — because the architects and contractors installed flexible Thermaflex. Diffusers can be moved four feet in any direction without disconnecting Thermaflex — no complicated tearing out and refitting of rigid ducting will be needed.



You can see the flexibility assured by Thermaflex as runouts from main ducts to ceiling diffusers. This lightweight, durable, easy-to-handle metallic-laminate ducting is contributing a great deal to the usefulness of this new building over a long period of years. This installation is a conventional low pressure system. Thermaflex was used in 5", 6", 8" and 10" diameters. It is available in diameters up to 12 inches.

Laboratory tests have proved that Thermaflex will stand 1200° F. without any sign of combustion or melting — that it will stand pressure of 25 psi, which is 5x minimum standards of the New York Board of Standards and Appeals. Thermaflex bends around corners and obstructions with minimum friction loss . . . installs quickly and easily . . . eliminates costly elbows and special fittings.

Flexible Tubing

CORPORATION

GUILFORD, CONNECTICUT • LOS ANGELES 64, CALIFORNIA

Send the coupon today! Our engineers will show you how Thermaflex can save you up to 32% on installation costs.

Flexible Tubing Corporation, Dept. 7N Guilford, Connecticut
Please send me more information on Thermaflex.

Name_____

Title and Company_____

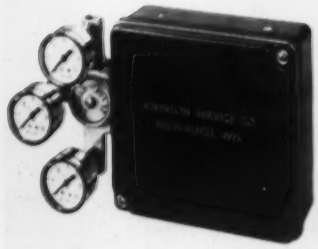
Address_____

City_____ Zone____ State_____

EQUIPMENT DEVELOPMENTS

Continued

life, minimize periodic maintenance. Powered by 115 volt reversible a-c or d-c motor or 90 psi air motor.



Pilot Positioner . . .

. . .with fast acting design said to provide high accuracy of control—*Johnson Service Co., Dept. HPAC, 507 E. Michigan St., Milwaukee* 1.

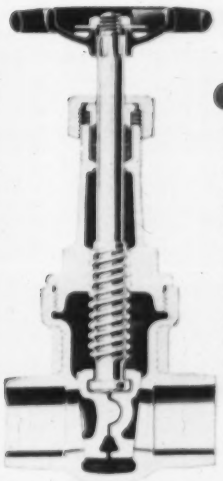
Recommended by company for applications requiring precise repositioning—even for very small changes in air pressure from controlling instrument. Maximum power available at all times for repositioning controlled device, says manufacturer. Supply air at 15 to 20 psi connected to positioner, with direct acting relay transmitting changes in pilot pressure from controlling instrument.

Alarm . . .

. . .for use with smoke controls, low water cutouts, flame failure systems, or wherever alarm is required to indicate unsafe conditions—*Way-Wolff Assoc., Dept. HPAC, 33 Fulton St., New York 38.*

"Larm-Tector" is completely assembled unit with red alarm light, audible buzzer of loud intensity, adjustable time delay switch, push-button and silencing relay circuit. For operation on 110 volts, 50 or 60

NEW LUNKENHEIMER SOLDER-END VALVES for COPPER TUBING



GATE

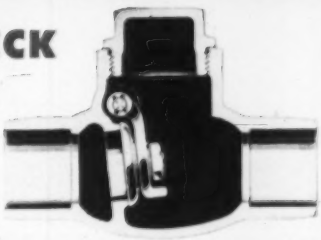
FIG. 2131
½" to 2"
125 lb. S.P.
200 lb. W.O.G.
Rising Stem
Double Wedge Disc

FIG. 2132
Solid Wedge Disc

FIG. 2133
Non-Rising Stem
Single Wedge Disc

SWING CHECK

FIG. 2145
½" to 2"
125 lb. S.P. 200 lb. W.O.G.
Renewable
Bronze Disc and Side Plugs



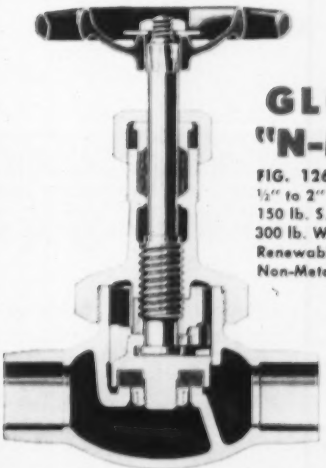
Easier, tighter installation! Lasting, trouble-free service!

Now you can take advantage of the superior quality, advanced design, and outstanding performance of famous Lunkenheimer Bronze Valves for your copper tubing installations!

The complete line of five patterns, with precision machined bores and ends, is designed for use with types K, L, and M copper tubing.

In operating features, materials, and workmanship, these valves are identical with the corresponding Lunkenheimer figures in the Screwed-End Bronze Valve series:

- *Non-Slip Handwheel assures tight closing*
- *Famous Stemalloy Stem—millions in use, without a single failure*
- *Hexagon Head Gland for easier repacking*
- *Extra-deep Stuffing Box reduces servicing*
- *Repacking Seats above stem threads*
- *Body and Bonnet of dense, close-grained, corrosion-resistant bronze*



GLOBE "N-M-D"

FIG. 126
½" to 2"
150 lb. S.P.
300 lb. W.O.G.
Renewable
Non-Metallic Disc

LUNKENHEIMER L QUALITY

FOR COMPLETE DETAILS ON THE NEWEST AND BEST SOLDER-END VALVES see your Lunkenheimer Distributor or request literature from The Lunkenheimer Company, Box 360, Cincinnati 14, Ohio.

L-855-18

BRONZE • IRON • STEEL • PVC

LUNKENHEIMER®

THE ONE *Great* NAME IN VALVES

The heart of the matter

IS IN THE COVERING

Available in standard pipe sizes and fittings in three thicknesses;
Light, (Ice Water to 30° F.)
Medium, (Brine and Ammonia to 0° F.)
Heavy, (Heavy Brine—25° F. and lower.)

UNITED CORK PIPE COVERING

THE IDEAL COLD LINE INSULATOR

Improper pipe insulation can mean an excessive loss in refrigeration efficiency and dollars to the cold storage operator. It is important to get the right pipe covering insulation that will have all these advantages:

Extremely low "K" factor
Retains over 80% of cold loss on piping
Easy and economical to install
Long trouble-free life
Fire retardant—Vermin resistant
No capillarity

LARGER STOCKS—FASTER DELIVERY—PERSONAL SERVICE

United Pipe Coverings are available from stock for prompt delivery—to fulfill your immediate installation requirements. Mail the coupon below for additional information or the United distributor nearest you.

Corkboard

Pipe Covering

Tank Lagging

UNITED BB CORKBOARD

Manufacturers of cork insulation for almost a half century

UNITED CORK COMPANIES
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UNITED CORK COMPANIES, 1 Central Ave., Kearny, N.J.

Please send United Cork Catalog. I am interested in

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NAME _____

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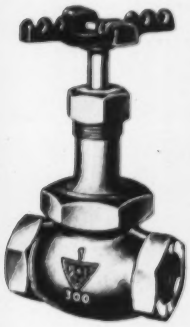
Engineering offices, or approved distributors, in key cities—coast to coast.

EQUIPMENT DEVELOPMENTS

Continued

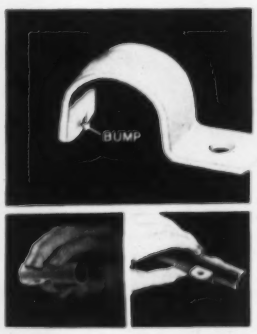
cycles. Transformer for operation on other voltages available.



Bronze Globe Valve . . .

. . .for industrial applications of steam, water, oil, gas service where continuous control or regulation of control is required—*R-P&C Valve Div., American Chain & Cable Co., Inc., Dept. HPAC, Reading, Pa.*

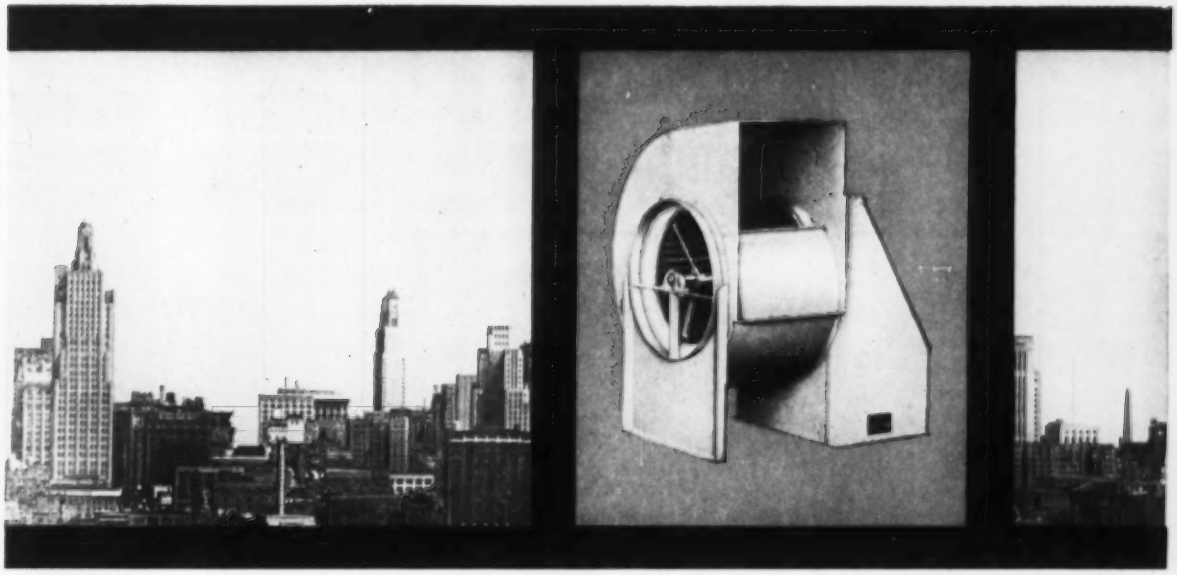
Recommended by company for frequent or continuous throttling, other severe applications. Rated for 300 lb steam at 550 F maximum—1000 lb OWG in ½ to 2 in. sizes, 600 lb OWG in 2½ and 3 in. sizes. Hydrostatic test pressure for ¼ to 2 in. sizes is 1500 lb, for 2½ and 3 in. is 800 lb.



"Snap-On" Straps . . .

. . .for pipe, rigid and thinwall conduit—*Holub Industries, Inc., Dept. HPAC, Sycamore, Ill.*

"Snap-on" action facilitated by "bump" inside strap which causes slight springing action and holds strap firmly in place. Straps are said



"THE FORGOTTEN FAN"

Because the fan on the roof often becomes "the forgotten fan," it frequently breaks down from exposure to wind and weather and from lubrication neglect.

With a weather eye toward this fact, Utility has designed a full series of precision-engineered blowers with permanently sealed, pre-greased ball bearings. They require no further greasing, and can't break down from lubrication neglect.

What's more, motors and drives are completely enclosed—making them forever impervious to dirt, dust, moisture and drastic temperature changes.

Manufacturers of heavy and standard duty blowers for heating, air conditioning and ventilating installations. Producers of blowers and blower parts for original equipment manufacturers. Write for catalogue data.

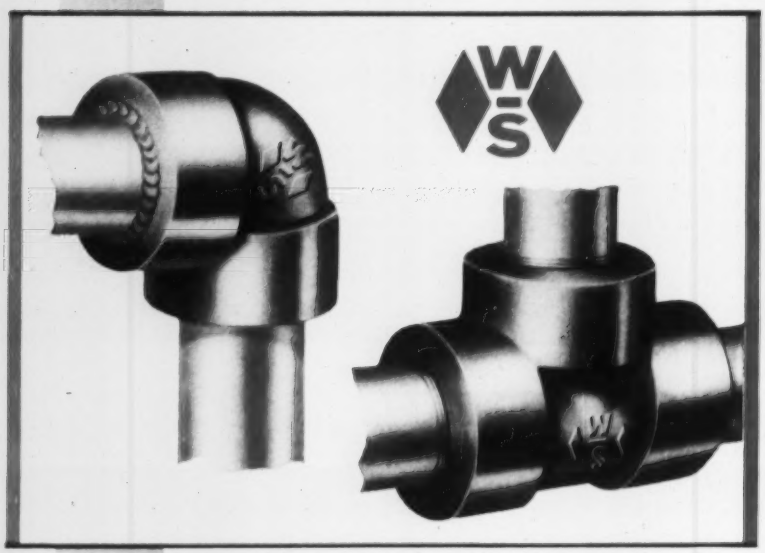
UTILITY FAN CORPORATION

911 East 59th Street, Los Angeles 1, California

UTILITY

A Division of Utility Appliance Corp.

2 Safe Ways to PROTECT Pressure Piping...



W-S SCREW-END and SOCKET-WELDING FORGED STEEL FITTINGS

Pipe joints are potential trouble spots in high pressure piping systems. Change in direction of flow causes turbulence, erosion and vibration. Watson-Stillman fittings are made to absorb this type of punishment. They're drop-forged for strength and toughness and safety-factor designed for the protection of your piping.

Choose between a welded piping system and a screwed one to suit your needs. Then choose W-S Screw-End or Socket-Welding Fittings to join your pipe. They're available in sizes ⅛" to 4" for piping up to 6000 lb. W.O.G. class. For high temperature or corrosive service you can get W-S Forged Stainless and Alloy Steel Fittings, too. Send today for our informative catalogs.

W-S FITTINGS DIVISION

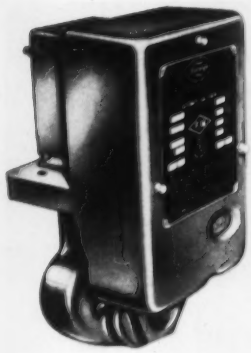
H. K. PORTER COMPANY, INC.

Roselle, New Jersey

EQUIPMENT DEVELOPMENTS

Continued

to save time, make neater installations, leave both of installer's hands free. In sizes ½ to 2 in. for thinwall conduit, ⅜ to 2 in. for rigid conduit and pipe.



Gas Valves . . .

. . . designed for fast, reliable closing, slow opening—*Electronics Corp. of America, Combustion Control Div., Dept. HPAC, Cambridge, Mass.*

For use with company's flame safeguard systems, motor operated units are said to have powerful compression type spring that "automatically" shuts off fuel in 0.8 sec. Cited feature is availability of position indicating switch, which performs as safety interlock.

Cutter Wheel . . .

. . . with honed edge design—*Beaver Pipe Tools, Inc., Dept. HPAC, Warren, Ohio.*

Fits all standard make No. 2 pipe cutters, pipe machine wheel cutoffs. Specially honed edge is said to give easier cuts, be harder and more durable. Packed 12 to a box.

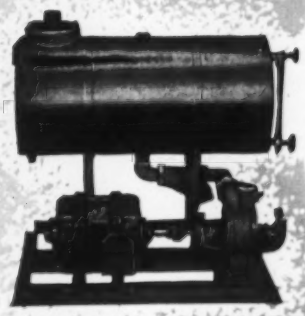
SKIDMORE PUMPS have set a standard for performance and dependability since 1921

SPECIFY WITH CONFIDENCE

There's a Skidmore Pump designed for each and every heating requirement.
Write for bulletins

TYPE "CVS"
New, wider range of discharge pressures — from 10 to 40 lbs. Capacities range from 500 to 10,000 sq. ft. E.D.R.

TYPE "TM"
Completely assembled on either steel or cast iron base — capacities, for boilers up to 250 H.P., with discharge pressures to 150 lbs.



TYPE "HS"
Sturdily constructed for dependable service at small investment — capacities, 1,000 to 65,000 sq. ft. E.D.R., discharge pressures from 10 to 75 lbs.

VACUUM TYPE
Automatically adjusts itself to the varying conditions of the system. Efficiency maintained. Capacities ranging from 5,000 to 100,000 sq. ft. E.D.R.

TYPE "UV"
Designed for low return installations — capacities, 2,000 to 40,000 sq. ft. E.D.R. and discharge pressures from 10 to 75 lbs.

Send Coupon For Bulletins

SKIDMORE CORPORATION
ST. JOSEPH, MICH.

SKIDMORE CORPORATION, ST. JOSEPH 10, MICHIGAN

Please send bulletins on the following (pumps checked below.)

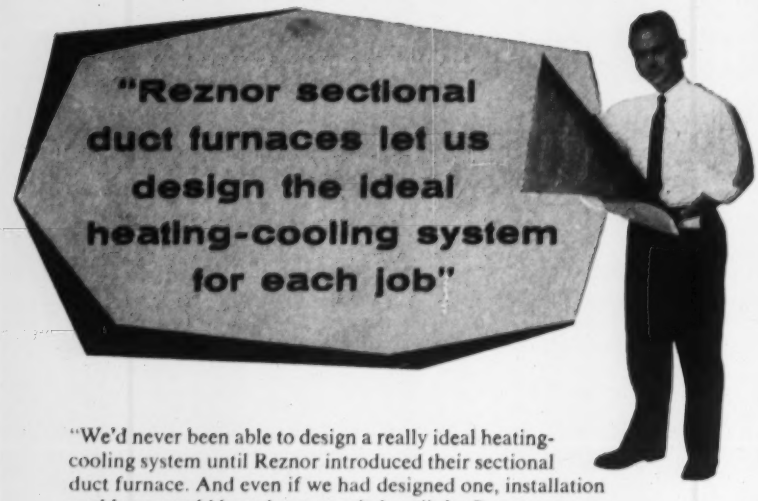
CVS TM HS UV VACUUM

Name .....

Firm .....

Address .....

City ..... State .....



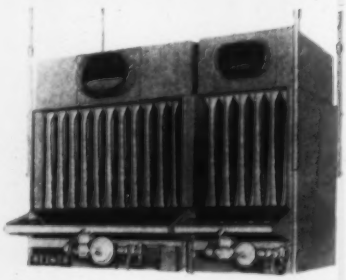
"We'd never been able to design a really ideal heating-cooling system until Reznor introduced their sectional duct furnace. And even if we had designed one, installation problems would have been stymied until the Reznor sectional duct furnace came along.

"Sectional assembly eliminates the installation problems which formerly prevented the use of large capacity custom-engineered duct systems. With the new Reznor DS sectional duct furnaces, we can specify system capacities of two million BTU or more knowing that they can be assembled on the job from sections weighing no more than 315 pounds.

"Reznor sectional duct furnaces free us completely from packaged heating equipment which isn't exactly right for any one job because it has to be almost right for so many jobs. Now we start with a Reznor duct furnace, which is simply nothing more than a compact, highly efficient gas-fired heat exchanger with a complete set of combustion controls. To this we add the components for air moving, cooling, cleaning, and humidifying selected to meet exact job requirements. For our client it means greater efficiency, greater comfort, and lower cost.

"Reznor sectional duct furnaces are a heating engineer's dream come true . . . and our long experience with Reznor gas unit heaters gives us complete assurance that these new duct furnaces will be tops in efficient performance, dependable service and long life, too."

If you're not taking advantage of the design freedom these new units offer you, you're really missing something. Write today for free catalog or call your nearby Reznor distributor for details. You'll find him listed under "Heaters-Unit" in the yellow pages of your telephone directory.



REZNOR
THE WORLD'S LARGEST-SELLING GAS UNIT HEATERS
REZNOR MANUFACTURING COMPANY
51 Union Street, Mercer, Pa.

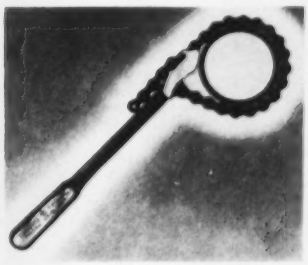
EQUIPMENT DEVELOPMENTS

Continued

Condensation Return . . .

. . .pumping units in single, duplex models—*Deming Co., Dept. HPAC, Salem, Ohio.*

"Hotshot" units rated up to 10,000 sq ft of direct radiation with pressures to 20 lb. High pressure units available to 50 lb. Shallow type, cast iron receivers in 6 or 20 gal sizes permit low connection to return line. No foundation bolts required. Can be set on floor or in shallow pit.



Chain Wrenches . . .

. . .designed for rugged use, long life —*Toledo Pipe Threading Machine Co., Dept. HPAC,* 1445 *Summit St., Toledo* 4.

Especially useful for close corner work on pipe sizes to 6 in., says company. Wrench jaw constructed so that the greater the force on the handle, the tighter the grip. In two models, ½ to 4 in., 3 to 6 in.

Welding Torch . . .

. . .featuring "quick shutoff" valve— *Air Reduction Sales Co., Div. of Air Reduction Co., Inc., Dept. HPAC,* 150 *E.* 42*nd St., New York* 17.

Recommended by company for light gage welding, brazing jobs. Especially suited for welding in light work where intermittent welding is

Our challenge stands

—anything that can be made of steel sheets can be made of

WHEELING

SOFTITE®

Galvanized Sheets

Believe it or not, this galvanized recessed ceiling light reflector housing was made by spinning. *"Impossible,"* you say? *"Can't be done with ordinary galvanized steel"?*

You are right! It *isn't* made of ordinary galvanized steel.

It's made of Wheeling SOFTITE, the tightest-coated galvanized sheet yet produced. So tight it won't chip, crack, flake or peel no matter how severely it is formed. It even takes *spinning* in its stride. In fact, *anything* that can be made of steel sheets can be made of Wheeling SOFTITE.

That's SOFTITE . . . made by the same company that developed Cop-R-Loy, the original copper-bearing steel pipe . . . and DUCTILITE, the original cold reduced tin plate. Now SOFTITE, the ultimate in ductile, tight-coated galvanized steel sheets . . . a product of Wheeling Steel Corporation, Wheeling, West Virginia.

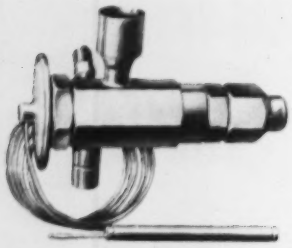
IT'S WHEELING STEEL

District Offices — Atlanta, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Detroit, Houston, New York, Philadelphia, St. Louis, San Francisco

EQUIPMENT DEVELOPMENTS

Continued

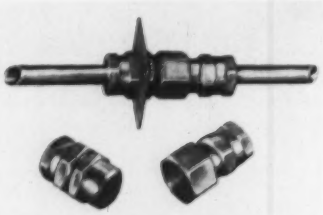
involved, says company. Valve feature permits quick closing of gas passages so that operator can move from one weld joint to another without loss of oxygen and acetylene, without carrying "live" flame.



Thermostatic Expansion . .

. . .valve for refrigerant control with interchangeable power element—*Detroit Controls Corp., Dept. HPAC, 5900 Trumbull Ave., Detroit.*

Feature makes field service easier, says company, since discharged or damaged power elements are replaced on job. Also permits valve to be used with different refrigerants, for various capacities.



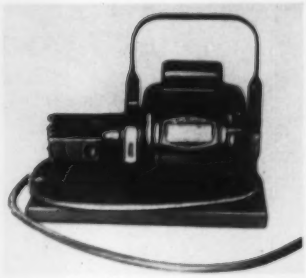
Refrigerant Coupling . . .

. . .with self sealing design—*Aeroquip Corp., Dept. HPAC, Jackson, Mich.*

Recommended by company for all types of fluorinated hydrocarbon refrigerant (Nos. 12 and 22) applications. Available in ¼ to 1½ in. OD tube sizes.

Portable Pump Set . . .

. . .with lightweight design, capacity of 250 gph—*Webster Electric Co., Dept. HPAC, Racine, Wis.*



Engineered to transfer any lubricating liquid, pump out fuel oil tanks which contain water. Set consists of pump, ¼ hp motor, 25 ft cord.

Steam Trap . . .

. . .with built-in strainer, designed to save space, cut maintenance time—*Strong, Carlisle & Hammond Co., Dept. HPAC, 1392 W. Third St., Cleveland 13.*

Other cited features are: small size and weight, "Hydro-Flex" bucket action for efficient operation under all load conditions, semi-steel body, stainless steel working parts. Strainer

(*Continued on page 205*)

Everybody NEEDS THIS NEW REED CHAIN WRENCH

Ratchet action works either way from either side

IDEAL FOR CLOSE QUARTERS

works where an ordinary pipe wrench won't!

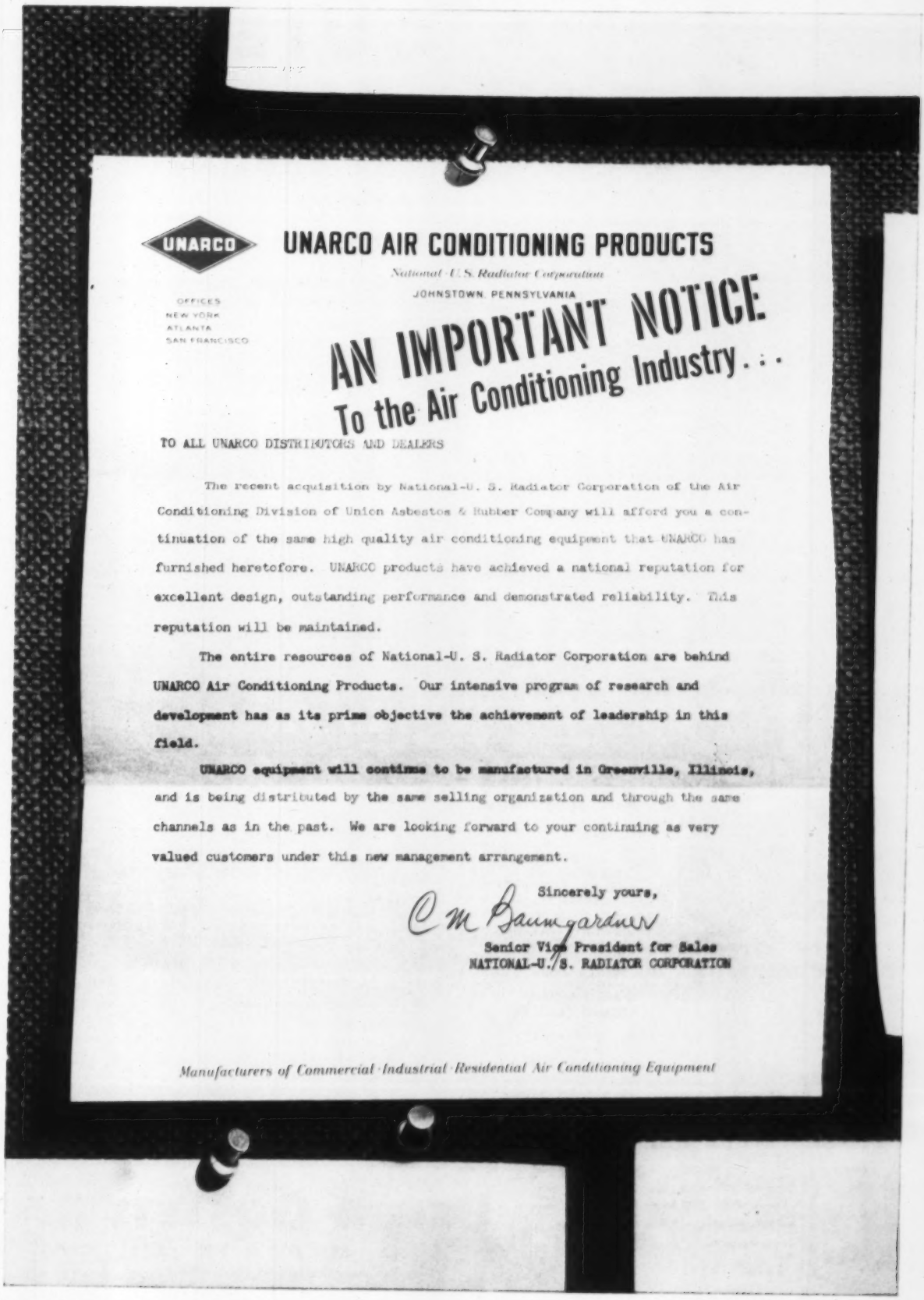
The Reed DU-ALL Chain Wrench does everything a conventional pipe wrench will do, and a great deal more. It gets into tight corners, close to baseboards or between parallel pipe lines, and holds round, square or irregular shapes . . . firmly, without "play" or crushing.

Its fast, ratchet action lets you tighten and "back off" without taking the wrench from the pipe.

All sizes of the DU-ALL wrench have ample chain length for fully tightening pipe up to the diameters handled by ordinary wrenches of equal lengths. Additional chain in the 14" model, however, gives the wrench a full working capacity up to 2" pipe and a holding capacity up to 4 inches. This is a major convenience in lining up soil pipe stacks, straightening studs, setting posts or turning any irregular shape within the leverage range of the 14" handle.

Whenever you want to work with pipe . . . ask for a REED Pipe Tool!

REED MANUFACTURING COMPANY • Erie, Pennsylvania



UNARCO

UNARCO AIR CONDITIONING PRODUCTS

National-U. S. Radiator Corporation

JOHNSTOWN, PENNSYLVANIA

OFFICES
NEW YORK
ATLANTA
SAN FRANCISCO

AN IMPORTANT NOTICE
To the Air Conditioning Industry. . .

TO ALL UNARCO DISTRIBUTORS AND DEALERS

The recent acquisition by National-U. S. Radiator Corporation of the Air Conditioning Division of Union Asbestos & Rubber Company will afford you a continuation of the same high quality air conditioning equipment that UNARCO has furnished heretofore. UNARCO products have achieved a national reputation for excellent design, outstanding performance and demonstrated reliability. This reputation will be maintained.

The entire resources of National-U. S. Radiator Corporation are behind UNARCO Air Conditioning Products. Our intensive program of research and development has as its prime objective the achievement of leadership in this field.

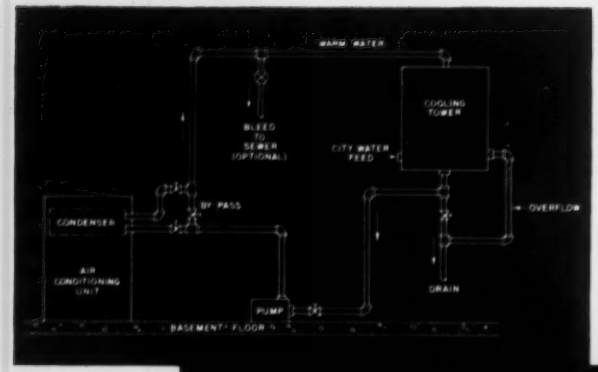
UNARCO equipment will continue to be manufactured in Greenville, Illinois, and is being distributed by the same selling organization and through the same channels as in the past. We are looking forward to your continuing as very valued customers under this new management arrangement.

Sincerely yours,

C M Baumgardner

Senior Vice President for Sales
NATIONAL-U. S. RADIATOR CORPORATION

Manufacturers of Commercial-Industrial-Residential Air Conditioning Equipment



QUIETER PUMPS

FOR COOLING TOWER APPLICATIONS

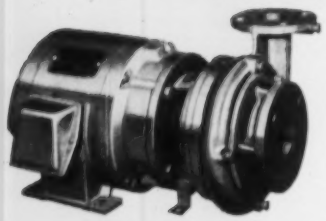
B&G 1522 CENTRIFUGAL PUMPS

Get rid of pump noise troubles in your cooling installations ...next time install a B&G 1522!

This pump is *really quiet*...because *both pump and motor* are equipped with long bronze sleeve bearings...and because of the noise-dampening flexible spring-type coupler.

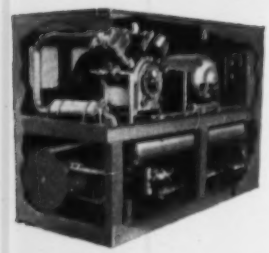
The B&G 1522 offers an impressive number of other features for dependable, low-cost operation. The "Remite" Mechanical Seal, for example, ends leakage troubles. It's self-lubricating—harder than glass—wear-proof. The impeller is dynamically balanced for smooth, vibrationless operation... the entire bearing bracket assembly, including shaft and sleeve bearing, is interchangeable. Servicing is simple—the 1522 separates into three parts.

All these plus values cost no more—the B&G 1522 Pump is *competitively priced!* It is available as an all-iron, bronze-fitted, all-bronze or a stainless steel unit, with capacities to 150 GPM, heads to 115 ft. Available in common sizes from factory stock. Send for Catalog.



B&G SERIES 1531-B CENTRIFUGAL PUMPS

Featuring vertical split case design...self-lubricating, leak-proof "Remite" mechanical seal ...latest NEMA motors. Superfinished shaft oversized for minimum deflection. Impeller is of sound hydraulic design, with balancing ring and relief holes to reduce thrust. Capacities to 1200 GPM, heads to 420 ft. Many sizes carried in factory stock.



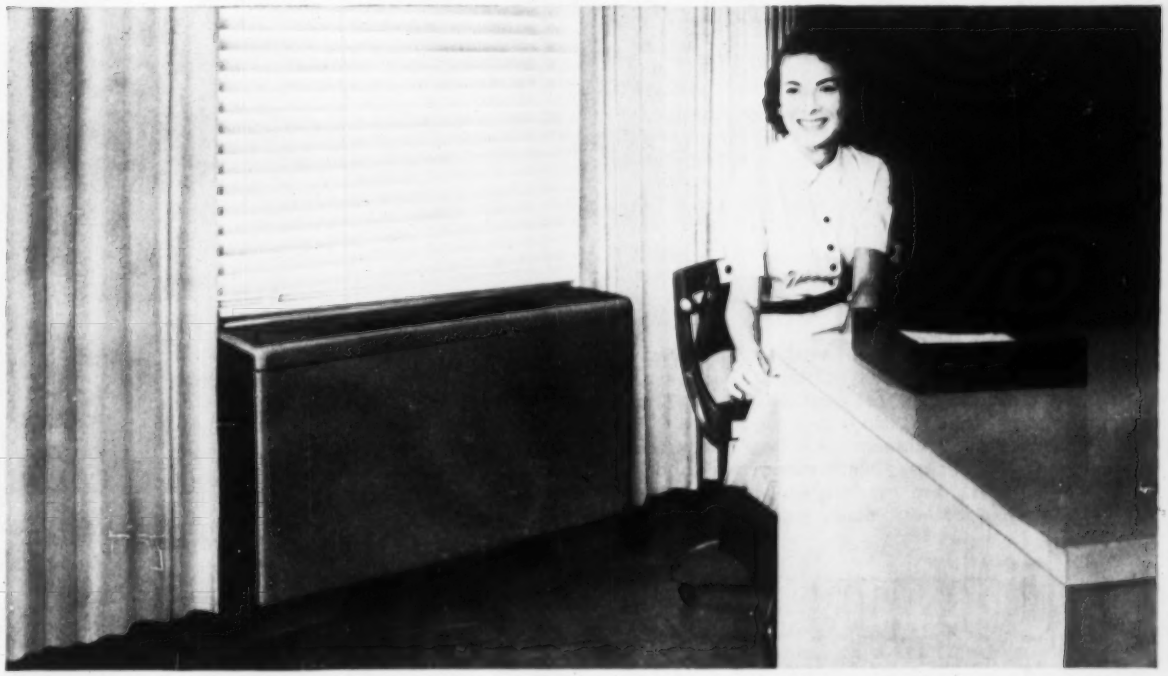
B&G PACKAGE LIQUID COOLER

A complete cooling unit for homes, apartments, commercial and industrial buildings. Low pressure drop through evaporator—non-recycling pump down—integrated electrical control system—complete wiring—are a few of many outstanding features. Send for Bulletin HB-755.

Send for your free copy of the B&G Six Step Manual for Designing Cooling Tower Systems.

BELL & GOSSETT
COMPANY
Dept. REO-5, Morton Grove, Illinois
Canadian Licensee: S. A. Armstrong Ltd., 1400 O'Connor Drive, W. Toronto

THE NEW *Airtherm* AIR CONDITIONING UNIT



COMBINES THE BEST TIME-PROVED FEATURES IN THE INDUSTRY

FOR NEW OR EXISTING

- ✓ OFFICES
- ✓ APARTMENTS
- ✓ MOTELS
- ✓ INSTITUTIONS
- ✓ HOTELS
- ✓ PUBLIC BUILDINGS

Here is Airtherm's answer to the demand for remote air conditioning without expensive ductwork. Features that have performed best in actual usage through the years are combined in this unit to give: (1) Maximum efficiency and operating life; (2) Quiet operation; (3) Versatility of installation; (4) Attractive appearance that blends with new or old buildings.

Airtherm units are made in four series from ½ to 2 ton nominal cooling capacity for cabinet or concealed installation, floor or ceiling.

AIRTHERM HEATING AND VENTILATING PRODUCTS

MAIL COUPON FOR DETAILS

Airtherm Manufacturing Co., Dept. A
700 S. Spring • St. Louis 3, Mo.

Please send specifications on the following products as checked ☐ Airtherm Air Conditioning Units ☐ Cabinet Unit Heaters ☐ Convectors ☐ Gas Fired Unit Heaters ☐ Propeller Fan Unit Heaters ☐ Centrifugal Fan Unit Heaters ☐ Direct Fired Space Heaters.

NAME ..... FIRM .....

STREET ADDRESS ..... CITY ..... STATE .....

Big duct, big saving with ULTRALITE Insulation*

There's a big saving in heat loss (or heat gain) due to ULTRALITE's superior thermal efficiency. There's a big saving in application cost, too, because blanket rolls of ULTRALITE glass fiber insulation wrap quickly around ducts of every size and shape . . . and because ULTRALITE's long-fiber strength makes it easy to secure in place by methods not practical with ordinary glass fiber blankets.

Easy application and low applied cost are also highlights of ULTRALITE Duct Liner, an outstanding acoustical product specifically designed to silence duct noise. Both ULTRALITE Duct Insulation and Duct Liner are available through a nationwide network of distributors. **See adjoining column for name of your local distributor.**

GUSTIN-BACON

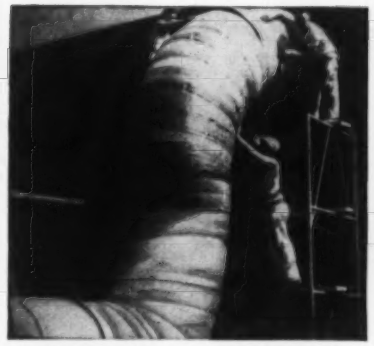
Manufacturing Company gb

Molded glass fiber pipe insulation • Pipe coverings and fittings

220 W. 10th ST., KANSAS CITY, MO.

*Trademark Reg.

High velocity air conditioning ductwork on the Hilton Palmer House, Chicago
Insulation Contractor: Culberg Asbestos Co.



G-B ULTRALITE DISTRIBUTORS

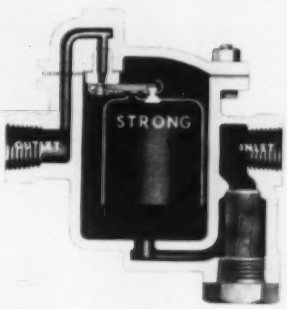
(See ad on facing page)

ALBUQUERQUE, Mt. States Insulation Co.
AMARILLO, Ball Distributing & Engr. Co.
APPLETON, J. D. Wilson Co.
BILLINGS, Mont., L. W. Worthington
BIRMINGHAM, Ala., Shook & Fletcher Supply
Southern States Iron Roofing Co.
BROOKLINE, Mass., Homans-Kohler, Inc.
BUFFALO, Frontier Insulation & Supply Co.
CHARLESTON, W. Va., Baldwin Asbestos Products Co.
CHARLESTON HEIGHTS, S. C., Stafford Insulation Co.
CHICAGO, E. C. Carlson Co.
CINCINNATI, R. E. Kramig & Co.
CLEVELAND, The Miles Materials Co.
COLUMBIA, S. C., Southern States Iron Roofing Co.
COLUMBUS, Santeler Brothers
DALLAS, Insulation Supply Co., Inc.
DAVENPORT, Republic Electric Co.
Payne-Ladewig, Inc.
DENVER, Gene Wright Lumber Co.
DETROIT, Coon-DeVisser Co.
EL PASO, Insulation & Specialties Co.
FARGO, N. D., Smith, Inc.
FT. SMITH, Ark., Gunn Distributing Co.
FT. WAYNE, Ind., M. H. Hilt, Inc.
FT. WORTH, The Bracken Co.
GREENSBORO, N. C., Starr Davis Co., Inc.
HOUSTON, Precision Insulation Co.
INDIANAPOLIS, Central Supply Co.
IRON MOUNTAIN, Mich., Champion, Inc.
JACKSON, Miss., Machinery Sales & Service Co., Inc.
JACKSONVILLE, Fla., Ferber Sheet Metal Works, Inc.
JOPLIN, Mo., Joplin Cement Co.
KANSAS CITY, Kelley Asbestos Co.
LITTLE ROCK, Gunn Distributing Co.
LOS ANGELES, Western Fibrous Glass Products
Plant Insulation Co.
LOUISVILLE, General Insulation & Roofing Co.
MADISON, Wis., J. D. Wilson Co.
MEMPHIS, John A. Denie's Sons Co.
MIAMI, Southern States Iron Roofing Co.
MILWAUKEE, J. D. Wilson Co.
NASHVILLE, Southern States Iron Roofing Co.
NEW HAVEN, Conn., Insulation Supply Co.
NEW ORLEANS, Eagle Asbestos & Packing
NEW YORK, Eastern Steam Specialty Co.
OKLAHOMA CITY, Ball Distributing & Engineering Co.
OMAHA, Cardinal Supply & Mfg. Co.
PHILADELPHIA, John F. Scanlan, Inc.
PITTSBURGH, D. J. Kennedy Co.
PHOENIX, Ariz., Kircher Asbestos & Rubber Co.
RALEIGH, N. C., Southern States Iron Roofing Co.
RICHMOND, Va., Southern States Iron Roofing Co.
ROCKFORD, Ill., Mott Brothers Co.
SALT LAKE CITY, Bullough Asbestos Supply Co.
SAN ANTONIO, The Bracken Co.
SAN DIEGO, Western Fibrous Glass Products
SAN FRANCISCO, Western Fibrous Glass Products
SAVANNAH, Ga., Southern States Iron Roofing
SCHENECTADY, N. Y., Jon Tree Sales & Supply Co.
SEATTLE, Western Fibrous Glass Products
ST. LOUIS, A. G. Brauer Supply Co.
ST. PAUL, Asbestos Products, Inc.
SYRACUSE, N. Y., Industrial Supply Co.
TAMPA, Fla., Eagle Roofing & Art Metal Works, Inc.
TALLAHASSEE, Fla., Capital Refrigeration & Supply
TULSA, Okla., Ball Distributing & Engr. Co.
WASHINGTON, Walter E. Campbell Co., Inc.
WICHITA, General Metals, Inc.
VANCOUVER, B. C., Fleck Brothers Limited

GUSTIN gb BACON

EQUIPMENT DEVELOPMENTS

Continued from page 198



located on inlet side to catch foreign matter before it can clog trap. For pressures to 150 psig. Inlet, outlet tapped hole sizes are ½ and ¾ in.

D-C Rectifier Welder . . .

. . . with "Diverter Path" control—*Hobart Bros. Co., Dept. HPAC, Troy, Ohio.*

Case design permits removable side panels. Recessed control panel has polarity reversing switch, three coarse current adjustments with rheostat control for fine current adjustments. Rheostat can be removed for remote control. In 300 and 400 ampere models.

Dial Thermometers . . .

. . . with red pointer showing maximum and green pointer showing minimum readings, in addition to regular pointer—*Palmer Thermometers, Inc., Dept. HPAC, 2501 Norwood Ave., Cincinnati 12.*

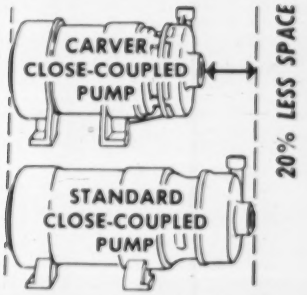
Are said to be easy to read and to reset, provide accurate indication of high or low temperature over given period of time. Pointers are feature of company's 3½ and 4½ in. thermometers.

NEW CARVER

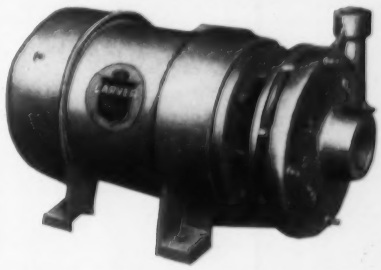
MODEL B PUMPS

are really

CLOSE COUPLED



They Save as Much as 20% in Overall Length!



When we say close-coupled we really mean close-coupled. The illustrations dramatically tell the story.

Mounted on the sturdy, short shafts of close-coupled motors these highly efficient Carver Model B Pumps are stronger, quieter in operation, more attractive . . . better in every way for every job.

And extremely important, of course, is the extraordinary compactness which makes them ideal where space is limited.

GUARANTEED PERFORMANCE assures lasting satisfaction.

CARVER also manufactures Frame-Type Pumps, Split-Case Pumps, Submersible Sump Pumps and Self-Priming Pumps.

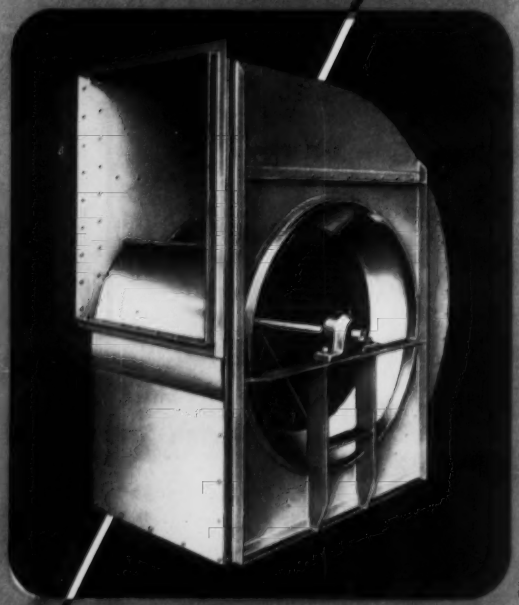
Ask for Bulletins

CARVER PUMP CO.
1460 Hershey Avenue
Muscatine, Iowa

CARVER

The quality name in pumps

ALADDIN FANS



for built-in quality

CERTIFIED RATINGS

AUTHORIZED BY NAFM

- EFFICIENT
- QUIET OPERATING
- CERTIFIED RATINGS

ALADDIN Series 94 Fans are available in 22 sizes of both backwardly inclined and forwardly curved types. Both types have been designed for the lowest rotational speeds consistent with high efficiency over the widest possible range of operating conditions.

Each fan is ruggedly built...fully equal to the job for which it is designed, and is backed by twenty-five years of know-how in manufacturing all types of air handling equipment.

Write for complete data

ALADDIN HEATING CORPORATION
1111 WEST AVENUE 137 · SAN LEANDRO, CALIF.
REPRESENTATIVES IN ALL PRINCIPAL CITIES IN THE WEST

EQUIPMENT DEVELOPMENTS

Continued

PVC Expansion Joints . . .

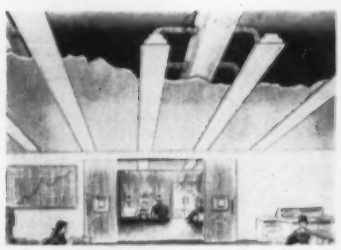
. . . in 1, 2, 3 in. sizes—*Tube Turns Plastics Inc., Dept. HPAC, 2929 Magazine St., Louisville* 11.

Slip type, unplasticized polyvinyl chloride joints may be used with smaller diameter piping by employing reducing bushings. All sizes allow 3¾ in. expansion. Designed for use with rigidly fixed PVC piping subjected to thermal cycles. Tested at pressures to 325 psi, temperatures to 140 F, company reports.

Plaster Mounting Ring . . .

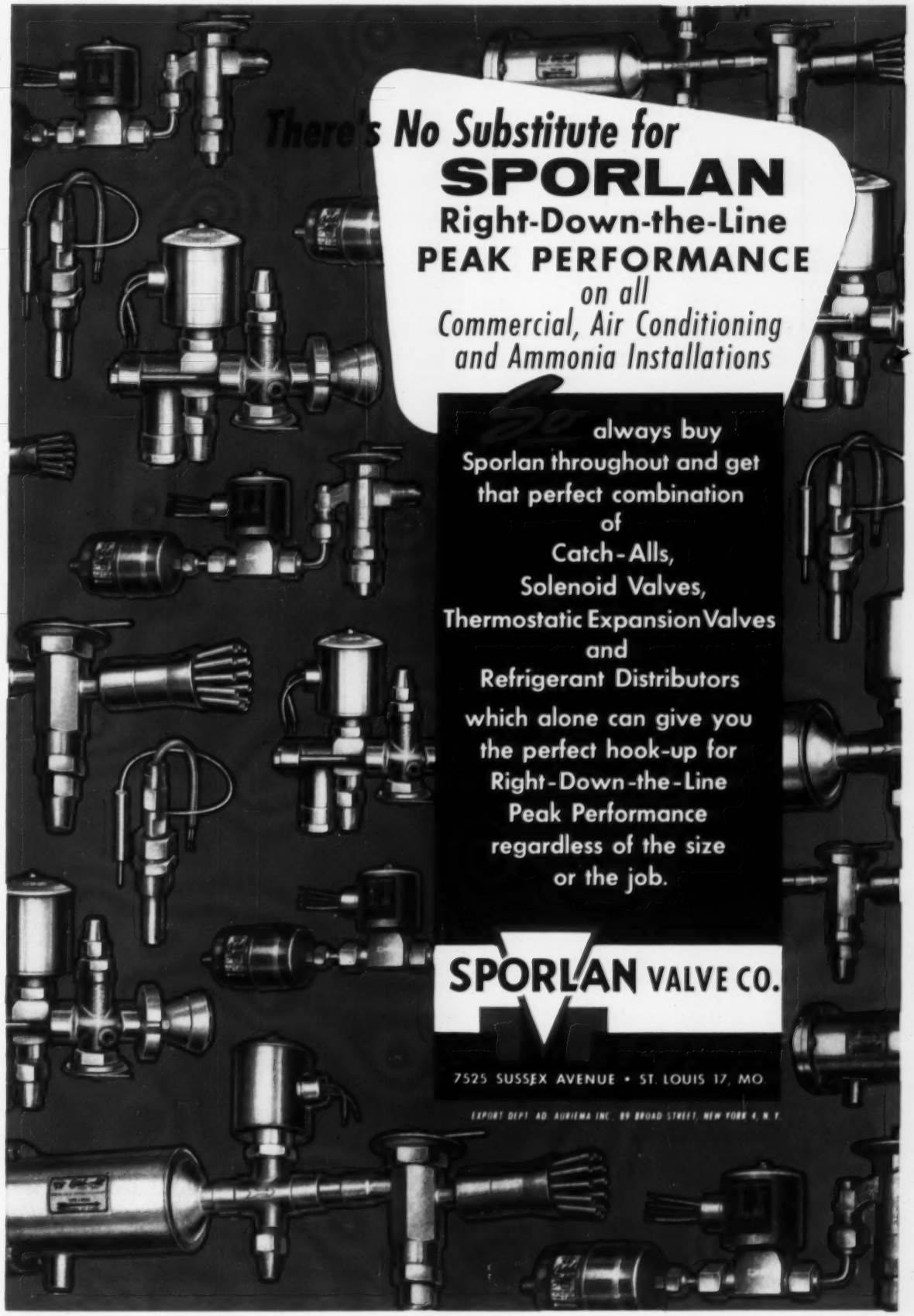
. . .designed to cut ceiling diffuser flush mounting costs, prevent diffuser from sagging away from ceiling—*Titus Mfg. Co., Dept. HPAC, Waterloo, Iowa.*

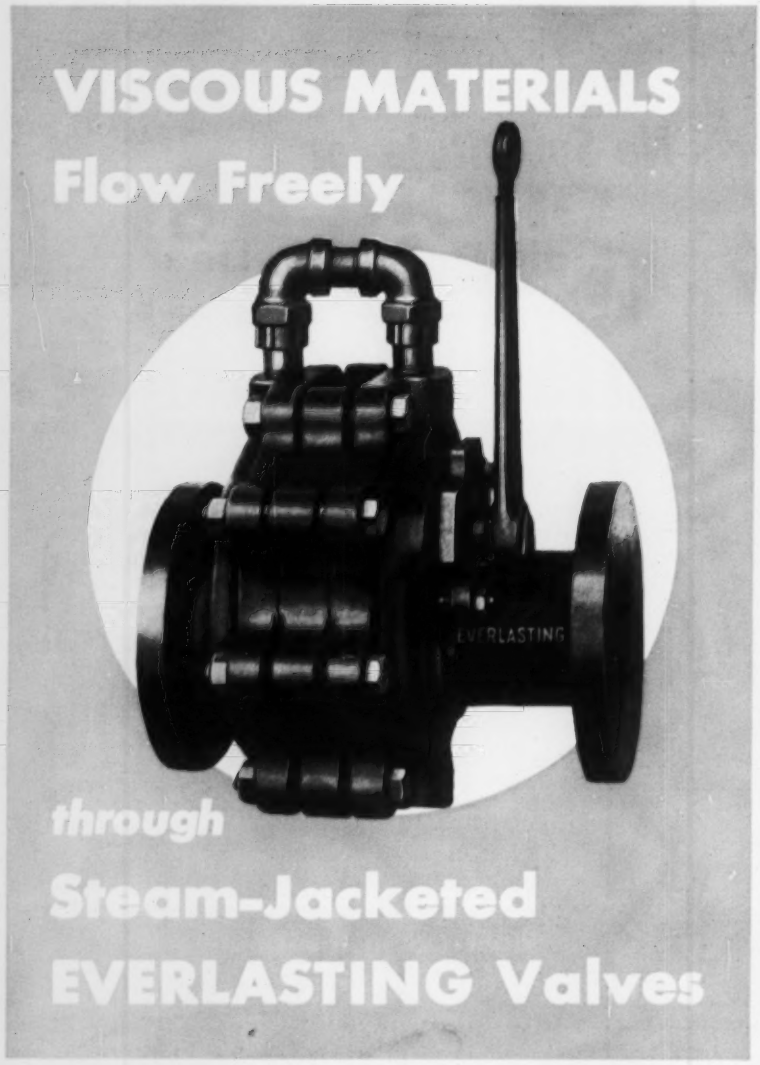
"Model PMR" ring serves as combination ceiling diffuser mounting ring and plaster ground and can be used for flush mounting on all types of ceilings, says company. Installed in two steps: slip neck of ring over duct; secure it to lathing channels or ceiling construction being used, with two screws.

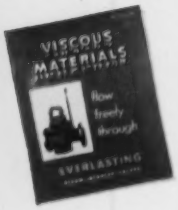


Air Diffuser-Lighting Fixture . . .

. . .combination designed to diffuse conditioned air,


There's No Substitute for
SPORLAN
Right-Down-the-Line
PEAK PERFORMANCE
on all
Commercial, Air Conditioning
and Ammonia Installations
always buy
Sporlan throughout and get
that perfect combination
of
Catch-Alls,
Solenoid Valves,
Thermostatic Expansion Valves
and
Refrigerant Distributors
which alone can give you
the perfect hook-up for
Right-Down-the-Line
Peak Performance
regardless of the size
or the job.
SPORLAN VALVE CO.
7525 SUSSEX AVENUE • ST. LOUIS 17, MO.
EXPORT DEPT. AD. AURIEMA INC., 89 BROAD STREET, NEW YORK 4, N. Y.





The EVERLASTING Steam-Jacketed Valve has proven outstandingly successful in handling many different kinds of viscous materials, such as tar, asphalt, pitch, paraffin, waxes, molten sulfur, etc.

Available in sizes 1½ in. to 6 in. inclusive, in iron body for 125 psi and cast steel for 150 psi.

For further details, write for Bulletin E-200.

For "everlasting" service, use

EVERLASTING Valves

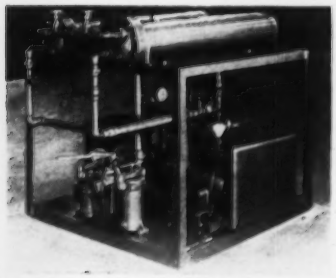
EVERLASTING VALVE CO.
61 FISK STREET, JERSEY CITY 5, N. J.

EV300

EQUIPMENT DEVELOPMENTS
Continued

provide illumination—Lighting by *Benjamin Electric Mfg. Co., Dept. HPAC, Des Plaines, Ill.* Air diffusion by *Pyle-National Co., Dept. HPAC, 1373 N. Kostner Ave., Chicago* 51.

Is said to simplify engineering, make possible cleaner and more attractive interior design, lower initial cost. Where minimum cooling is needed, fixtures can remain unattached to air duct or shut down.



Heater-Pump Sets . . .

. . . for heavy fuel oils—*York-Shipley, Inc., Dept. HPAC, York, Pa.*

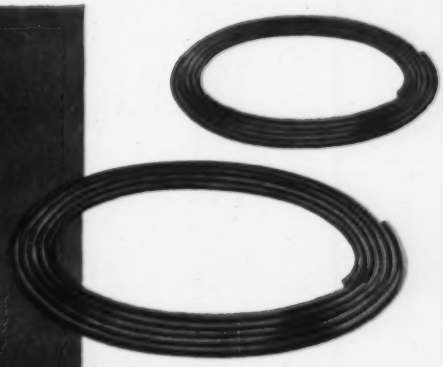
Packaged combinations for preheating, straining, pumping No. 5, No. 6, "Bunker C" fuel oils available in duplex (shown), single assemblies. In four sizes for 100, 225, 400, 700 gpm with ½, ¾, 1, 1½ hp motors, respectively.

Cast Iron Boiler

. . . designed exclusively for oil firing —*Heating & Air Conditioning Div., National-U.S. Radiator Corp., Dept. HPAC, Johnstown, Pa.*

Engineered to meet heating, domestic hot water heating require-

Specify READING COPPER TUBE



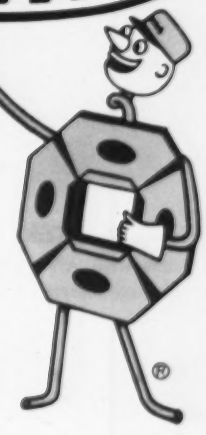
and discover the BIG DIFFERENCE!

...You'll always ask for it by Name!

Personal Service is the *BIG PLUS* that makes the *BIG DIFFERENCE* when you specify Reading Copper Tube. Reading's streamlined "shirt-sleeve" service —from our top brass on down—eliminates delays . . . speeds deliveries . . . from mill to distributor to contractor.

This Personal Service—plus a reputation for uniform quality second to none in the industry—are reasons why more and more contractors every day are specifying Reading Copper Tube.

READING COPPER · BRASS TUBE



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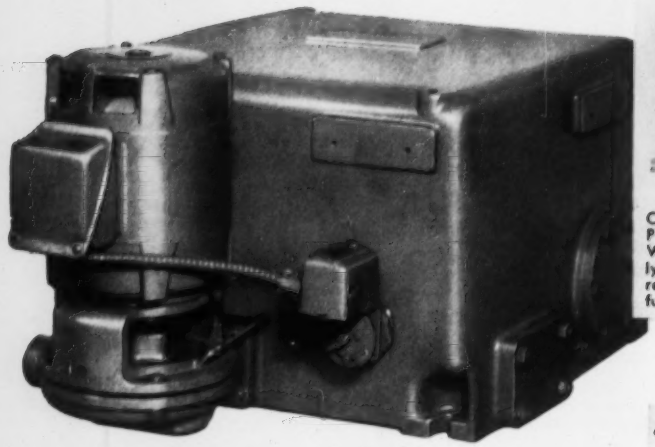
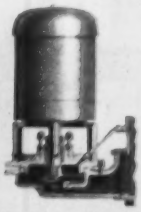
HOFFMAN

CONDENSATION PUMPS



Type "HCS" and "HCD"



Cross section of Pump assembly. Water flows directly from cast iron receiver into centrifugal pump.

Single & Duplex Units—Ratings through 150,000 sq. ft. E.D.R. Watchman Pump—a small compact unit for capacities of 500 to 8,000 sq. ft. E.D.R. and 20 lbs. Discharge Pressure.

featuring— • **Compact Design** • **Low Suction Velocities** • **Bronze Fitted throughout** • **Stainless Steel Shaft** • **No piping between pump and receiver** • **Rigid motor support for quiet operation** • **Cast iron receiver**

Motor and Pump unit is designed vertically to place the motor high above the floor—away from dirt and water. Standard ball bearing motors are used.

A COMPLETE LINE OF STEAM AND

F&T Traps

Steam Vents

Supply Valves

HOFFMAN SPECIALTY [illegible]

EQUIPMENT DEVELOPMENTS

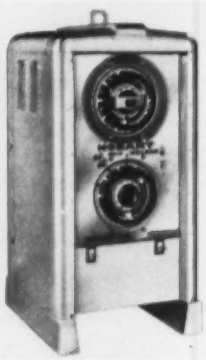
Continued

ments of installations for small commercial buildings, motels, similar establishments. In six sizes with net IBR steam ratings 760 to 2260 sq ft, net IBR water ratings 1355 to 3775 sq ft. Four sizes of built-in tankless heaters, three sizes of storage tank heaters available.

Tachometer Takeoff . . .

. . .heads with AN screw mounts for aircraft tachometer takeoffs, SAE screw mounts for gasoline, diesel, marine, railway or stationary engines, compressors—*Metron Instrument Co., Dept. HPAC,* 432 *Lincoln St., Denver* 9.

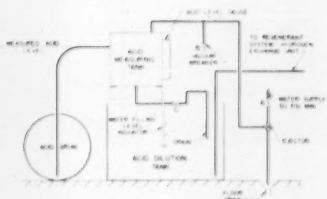
Rugged construction gives very long life under continuous operation, says company. Uses no brushes, slip rings, other parts that need regular maintenance or replacement. Must be used in combination with indicators manufactured by company.



A-C/D-C Arc Welder . . .

. . .rated 200 amperes, 40 volts, with current range 10 to 300 amperes—*Hobart Bros. Co., Dept. HPAC, Troy, Ohio.*

Cited features include new case with removable side panels, recessed control panel and selector switch which permits operator to choose a-c, d-c straight, or d-c reverse welding current.



Acid Handling System . . .

. . .for plants using acid in carboys, drums—*Graver Water Conditioning Co., Dept. HPAC,* 216 *W.* 14*th St., New York* 11.

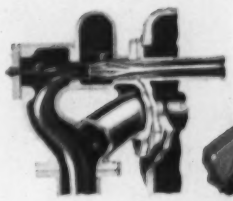
Can be furnished as part of regenerant system of water treatment processes such as demineralization, hydrogen zeolite ion exchange, acid stabilization. Designed to provide safe, simple method of handling any amount of acid that must be diluted with water. Vacuum type system enables transfer, measurement, dilution without lifting carboys or drums, without subjecting any vessels to positive pressures.

HEATING PUMPS

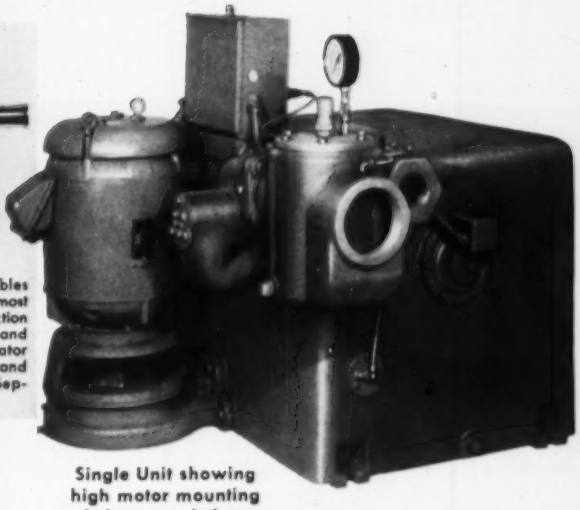
VACUUM PUMPS

Single and Duplex Units—Ratings through 100,000 sq. ft. E.D.R. Hoffman famous Jet Vacuum Producer assures greater efficiency—low upkeep. Cuts operating time and power bills approximately ½.

• Engineered to remove up to 300% of rated capacities of air at start of heating cycle • Shorter warm-up period means economies • Standard Capacity for ordinary requirements—Special Capacity where larger air and water capacities are necessary • Cast iron receiver



Jet Vacuum Producer enables Hoffman Pump to handle almost boiling water. Cross section view shows air, vapor and condensate from Accumulator Tank entrained by Jet and being discharged to Air Separating Tank.



Single Unit showing high motor mounting and close coupled pump

HOT WATER HEATING SPECIALTIES

Circulating Pumps

Balancing Elbows

Water Vents

Sold by Leading Wholesalers of Heating and Plumbing Equipment

EQUIPMENT DEVELOPMENTS

Continued

Controller . . .

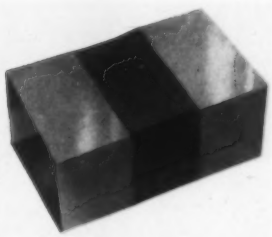
. . .for monitoring, control of temperatures —200 to 3000 F—*Tipp Mfg. Co., Dept. HPAC, Tipp City, Ohio.*

Recommended by company for use in fire alarm systems, institutional and laboratory equipment, distilling processes, petroleum refining, autoclaves, chemical processes, bearings, other applications. Depending on model, "Tipp-Tron" either prevents temperatures from rising (high limit) or falling (low limit) past preset points. Double limit units also available.

Flexible Plastic Pipe . . .

. . .made of virgin polyethylene—*Supplex Co., Div. of American Hard Rubber Co., Dept. HPAC, Garwood, N. J.*

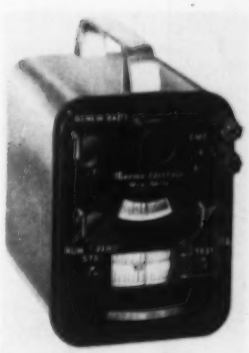
Line consists of ½, ¾, 1, 1¼, 1½, 2 in. inside diameter sizes. ½, ¾, 1 in. sizes for pressure ratings to 75 psi, 1¼ in. rated at 68 psi, 1½ in. at 61 psi, 2 in. at 52 psi. Packed in coils 200 to 400 ft depending on diameter.



Flexible Connector . . .

. . .material for air conditioning duct systems—*Duro-Dyne Corp., Dept. HPAC, 300 Third Ave., New Hyde Park, N. Y.*

Incorporates metal-to-fabric seam, designed to prevent fabric from pulling out, being cut. Packed in 50 or 100 ft rolls.



Portable Indicator . . .

. . .with small, versatile design—*Thermo Electric Co., Inc., Dept. HPAC, Saddle Brook, N. J.*

"MiniMite" potentiometer unit has scale 23½ in. long. Standard double scale range is zero to 1800 F for Iron-Constantan, zero to 2400 F for Chromel-Alumel. Other ranges also available. Dual application feature cited by company.

"Read why more and more Heating Contractors are installing

TACO AIR-SCOOPS"

WITH A TACO AIR-SCOOP YOU INSTALL IT AND FORGET IT!

Here's Why:

First you install the Air-Scoop in the supply line. Second, you make a short connection from the Air-Scoop to the expansion tank. That's all you have to do. No call backs. No servicing!

A low-cost Taco Air-Scoop will make your installation complete . . . free of noise.

BETTER HEATING — Taco — BETTER WITH TACO

TACO HEATERS, INCORPORATED

1160 Cranston Street, Cranston 9, R. I.

Use this coupon for more information.

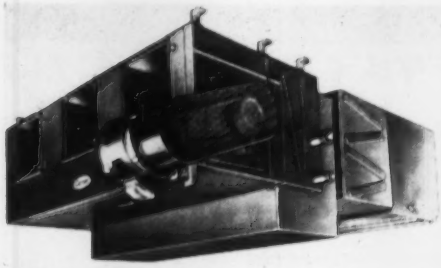
Send Technical Air-Scoop Data Sheet to:

Name

Address

EQUIPMENT DEVELOPMENTS

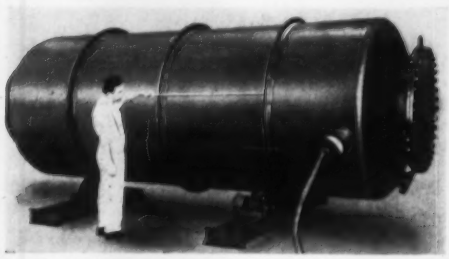
Continued



Heating, Ventilating Units . . .

. . .for large area buildings, schools, auditoriums, gymnasiums—*Carrier Corp., Dept. HPAC, Syracuse 1, N. Y.*

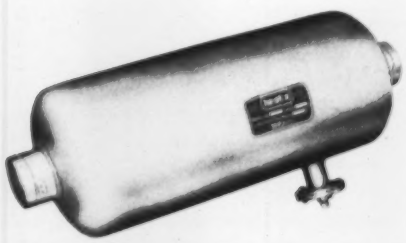
Greater versatility of application is cited feature of expanded line. Capacities of six coil sizes offered range 47,000 to nearly 2 million Btu, 1500 to 32,000 cfm. "Forward curved" fan designed for quieter, more efficient performance at relatively low speeds.



Purifier . . .

. . .designed to conserve water, steam—*V. D. Anderson Co., Dept. HPAC, 1935 W. 96th St., Cleveland 2.*

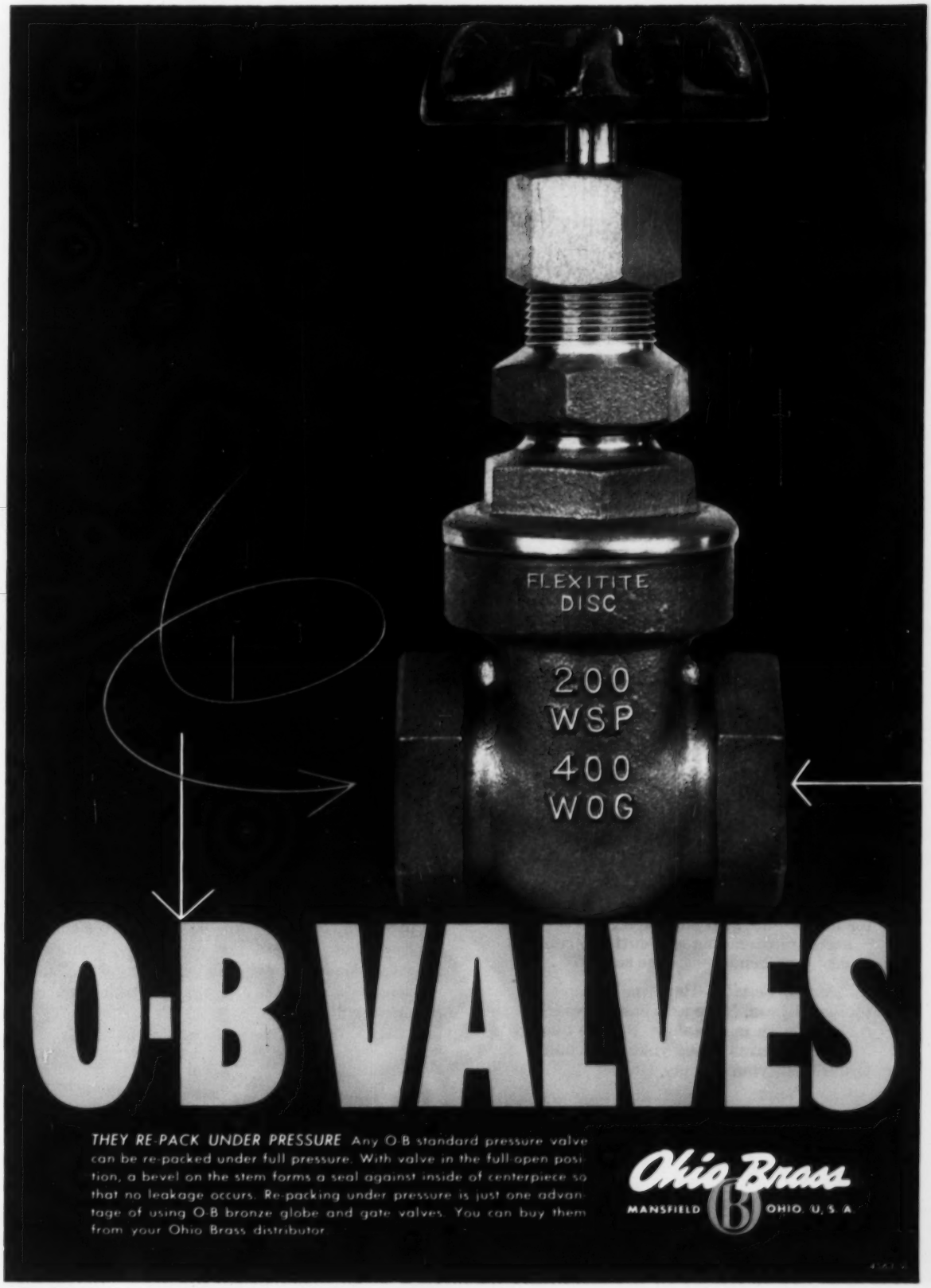
Instead of exhausting spent steam to atmosphere, "Hi-eF" unit is installed in low pressure steam lines on exhaust side to remove oil, pipe scale, other impurities so that steam can be returned to boiler, says company. Available in range of sizes.



Oil Separator-Mufflers . . .

. . .designed to silence refrigeration system noises, separate oil entrained with hot gas from compressor—*Heat-X, Inc., Dept. HPAC, Brewster, N. Y.*

"OSM" units also equipped with mechanism which "automatically" returns to crank-case all oil that is separated. In range 1 to 75 tons fluorinated hydro-



O-B VALVES

THEY RE-PACK UNDER PRESSURE Any O-B standard pressure valve can be re-packed under full pressure. With valve in the full-open position, a bevel on the stem forms a seal against inside of centerpiece so that no leakage occurs. Re-packing under pressure is just one advantage of using O-B bronze globe and gate valves. You can buy them from your Ohio Brass distributor.

Ohio Brass
MANSFIELD OHIO, U. S. A.

Not a Secret Vise!

Known Everywhere As Extra-handy and Rugged

RIDGID
Bench Pipe Vise—
8 sizes for
⅛" to 6" pipe

RIDGID

More-for-your-money pipe vises

Easy to Work With—LonGrip jaws for firmer pipe grip *plus* pipe rest for accurate threading and cutting. Built-in handy pipe bender—a time saver . . .

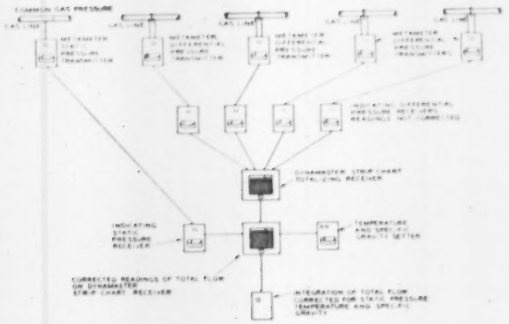
Years of Service—Replaceable long-life tool-steel jaws. Yoke and base of special tough malleable . . . Same quality in all RIDGID vises, yoke and chain. Order from your Supply House!

RIDGID
Work-Saver Pipe Tools

The Ridge Tool Company, Elyria, Ohio, U.S.A.

EQUIPMENT DEVELOPMENTS *Continued*

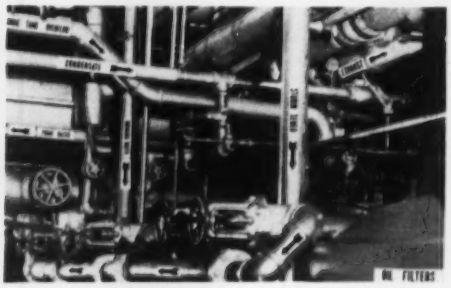
carbon refrigerant No. 12, 1 to 100 tons refrigerant No. 22.



Computing Telemetering System . . .

. . .designed to totalize several flow measurements, correct for such factors as temperature, pressure, specific gravity, supercompressibility in fluids—*Bristol Co., Dept. HPAC, Waterbury 20, Conn.*

Can also be supplied in types to perform averaging, totalizing, multiplying, dividing computations involving basic measured variables listed above.



Pipe Markers . . .

. . .for uniform marking system—*W. H. Brady Co., Dept. HPAC, 727 W. Glendale Ave., Milwaukee 9.*

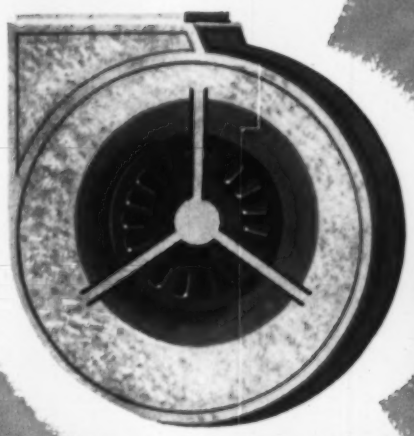
For tracing pipe lines through different rooms, departments, buildings. Are said to reduce maintenance down time, minimize operating errors, improve plant safety. Made of vinyl cloth with heavy duty, "all temperature" adhesive and silicone-plastic overcoating for long life.

Epoxy Resin Adhesives . . .

. . .formulated to cure at room temperature under con-

any shape...any size... any kind of ductwork is better with galvanized steel... is best with

WEIRKOTE



In manufacturing ductwork, galvanized steel has long been relied on for ease and economy of fabrication . . . also providing maintenance-free long life.

But now, ever more fabricators are turning to Weirkote to do the job. Why? . . . Because Weirkote is the *superior* galvanized steel sheet, produced by the most modern continuous galvanizing process . . . quality-controlled from start to finish. It has the tightest of tight zinc coatings . . . resists cracking, peeling, flaking and, above all, corrosion as does no other metal for ductwork of proved durability. Weirkote is far stronger, more rigid, more heat-resistant. These are only a few of the reasons why we say: *In the long run, galvanized steel . . . in the LONGER run, WEIRKOTE.* Let Weirton show you why!

WEIRTON STEEL COMPANY
WEIRTON, WEST VIRGINIA
a division of
NATIONAL STEEL CORPORATION

WEIRTON STEEL COMPANY

Stems can't seize...

BRONZE TRIM FIG. 333

ALL-IRON TRIM, FIG. 337

Both of these OIC Duo-Bolt gates have special stems. The Fig. 333 stem is OIC *Alloy-40* in sizes 2" and under . . . corrosion-resistant bronze with 20 to 30 times longer life than most other stem bronzes. It will not gall or seize. In fact, this alloy has all but eliminated stem replacement. The Fig. 337 stem is nickel-plated steel . . . highly resistant to pitting in the packing area, sturdy and long wearing.

Design includes bonnet drain ducts . . . recessed gasket seat

To protect against freezing, bonnet ducts allow complete drainage of the upper part of the valve. The male-female, gasketed body-bonnet connection assures a tight joint and prevents blown gaskets.

Exclusive cast-in seat rings

On sizes 2" and under, bronze trimmed valves include cast-in seat rings, *rolled* to make doubly sure that they cannot loosen in service. On sizes 2½" and larger, seat rings are screwed in. Seats are integral on all-iron trim valves. Both types include a button-head stem-to-wedge connection, flexible for non-binding wedge seating.

Immediate availability . . . long line

Order Duo-Bolt gates from your OIC Distributor or his field store. Sizes: ¼" to 4", screwed or flanged ends. Working pressures: 125 to 150 lbs. WSP, 200 to 225 lbs. cold WOG, non-shock. Request Form No. 1007 for more information.

THE OHIO INJECTOR COMPANY • WADSWORTH, OHIO

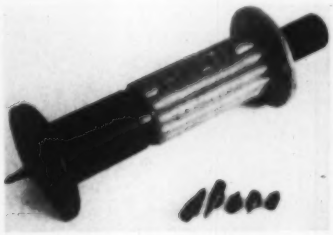
VALVES | FORGED & CAST STEEL, LUBRICATED PLUG, BRONZE & IRON VALVES

EQUIPMENT DEVELOPMENTS

Continued

tact pressure—*Minnesota Mining & Mfg. Co., Dept. HPAC, 123 Piquette Ave., Detroit 2.*

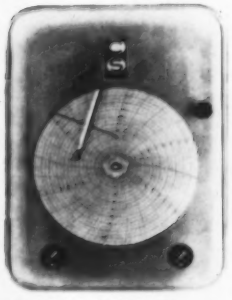
In three types said to cure to strong solid state without forming volatile by-products. All three recommended by company for bonding aluminum, brass, copper, steel, other metals to each other, to glass and to many plastics.



Drive Tool . . .

. . . for flush mounting small pipe hangers, small clips, small channels, straps, power control systems, sheet-metal ductwork—*Hilti Rapid Fastening Systems, Inc., Dept. HPAC, 55 Vandam St., New York 13.*

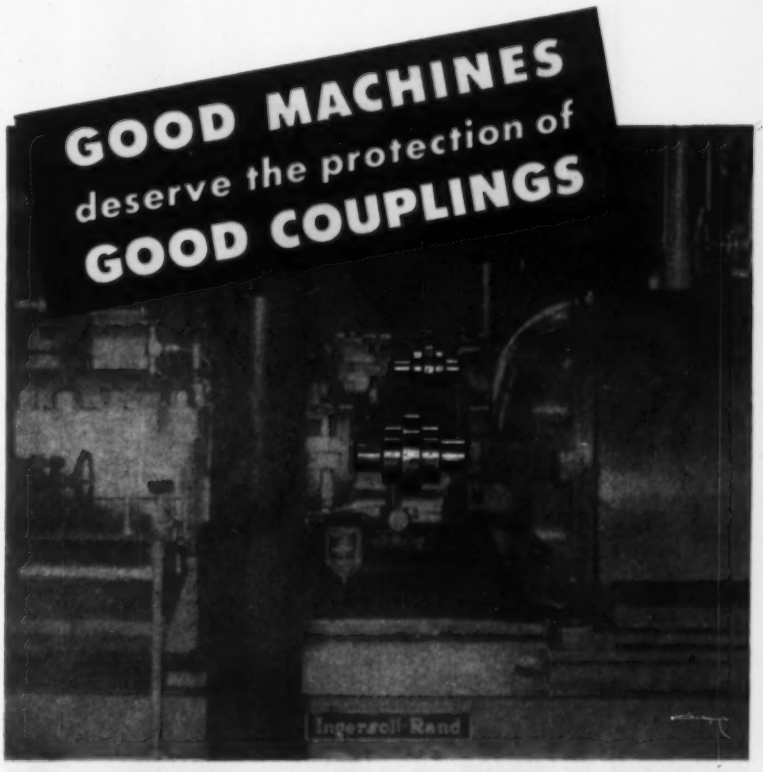
Single unit, hand powered drive tool developed to handle new series of internal threaded studs made for flush mountings. Designed to cut time, labor on most jobs in this category.



Controls . . .

. . . for pressure, temperature recording—*A. W. Cash Co., Dept. HPAC, P.O. Box 551, Decatur, Ill.*

"Type 57" pneumatic unit (shown) controls, records both pressure, temperature. Available models have either 9 or 12 in. spring or elec-



...and they get it with

Waldron
COUPLINGS

The motor driven boiler feed pump application pictured above needs a WALDRON coupling to make it a top engineering and mechanically perfect installation. That's why WALDRON is being specified by more and more pump and compressor manufacturers.

SHEAR PIN . . . CUT-OUT . . . FLOATING SHAFT . . . SPACER . . . OIL COLLECTOR
CONTINUOUS LUBRICATED . . . PLUS OUR HS HIGH SPEED COUPLING

Complete details in Catalog 57

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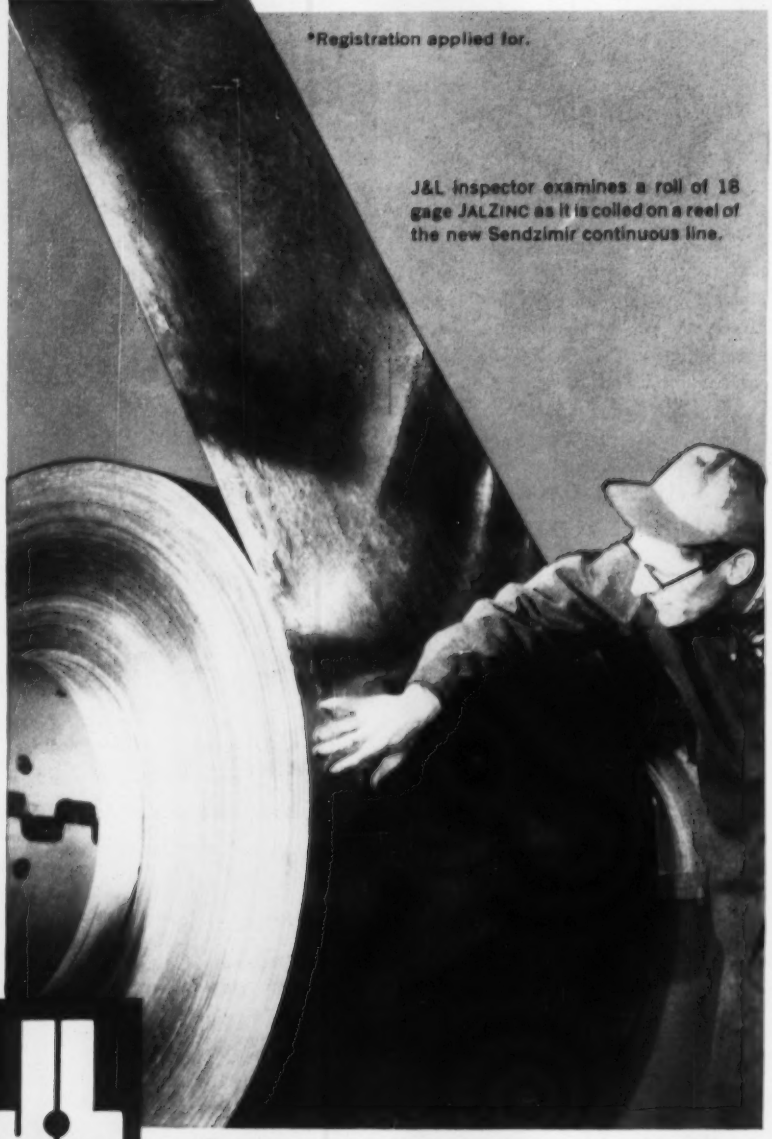
JALZINC*

*Registration applied for.



J&L inspector examines a roll of 18 gage JALZINC as it is coiled on a reel of the new Sendzimir continuous line.

JALZINC is Jones & Laughlin's new trade name for its *high quality* zinc coated steel sheet and coiled product. JALZINC answers your toughest forming, rolling and drawing problems.

Produced by the proven Sendzimir process, JALZINC has a tight, uniform coating that resists cracking and flaking. The high lustre finish greatly improves the appearance of your end product. JALZINC is available in a wide range of gages and widths in both cut lengths and coils.

Users are enthusiastic about JALZINC'S uniform ductility, flatness and surface finish. Write today for complete details.

Jones & Laughlin Steel Corporation
Dept. 511, 3 Gateway Center
Pittsburgh 30, Pa.

☐ Please send literature on JALZINC
☐ Please have J&L representative call

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Address _____

City _____ Zone _____

State _____

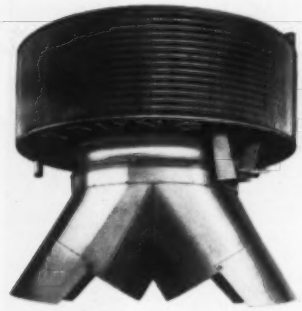
J&L STEEL

Jones & Laughlin
STEEL CORPORATION · PITTSBURGH

EQUIPMENT DEVELOPMENTS

Continued

tric driven charts and on-off, duplex on-off or 1-100 percent proportional action. Pressure ranges are 1-5 to 0-5000 psi (0-25,000 psi for 12 in. single pen only) and temperature range is 350 to 1200 F. "Type 58" recorder comes with either 6, 9, or 12 in. charts, either spring wound or electric driven; has one to four recording pens.



Unit Heaters . . .

. . . in two new vertical flow models —*Young Radiator Co., Dept. HPAC, Racine, Wis.*

One designed to exceed 1 million Btu per hr output. Recommended by company to heat airplane hangars, industrial buildings having extremely high ceilings difficult to heat because of air stratification. In three types: revolving diffuser which turns full 360 deg with adjustable vanes to vary diameter of air spread; "Aero-Jet II Nozzle" for extreme mounting heights; conventional "Spreadaire" diffuser adjustable to 15 deg angle.

Plastic Gasket . . .

. . . material formulated to solve vacuum line sealing problems—*Flexrock Co., Packing Div., Dept. HPAC,*

RUGGED, DEPENDABLE, ACCURATE

USG **GAUGES**

for *Every* heating and air conditioning application

The Fig. 500 is typical of the USG gauges used in heating and air conditioning applications.

With its cast iron case, wide bearing areas and movement made of dissimilar metals . . . the entire design is engineered for long service and minimized maintenance. Moreover, the cost is low . . . well below the price that might be expected for a gauge of its quality. Dial sizes range from 4½" to 12"; pressures from 0-15 to 0-1000 psi.

For some applications, contractors may prefer a lighter weight, drawn steel case gauge of the Fig. 500S series. These are also available for pressures up to 1000 psi, but in dial sizes from 2" to 4½".

Whether you buy as a contractor, or specify as an engineer, you'll be certain of quality and performance with USG gauges. As a manufacturer, buying gauges to be sold as a component of your heating or air conditioning equipment, you'll find it advantageous to do as 6 of 10 such manufacturers do . . . specify USG.

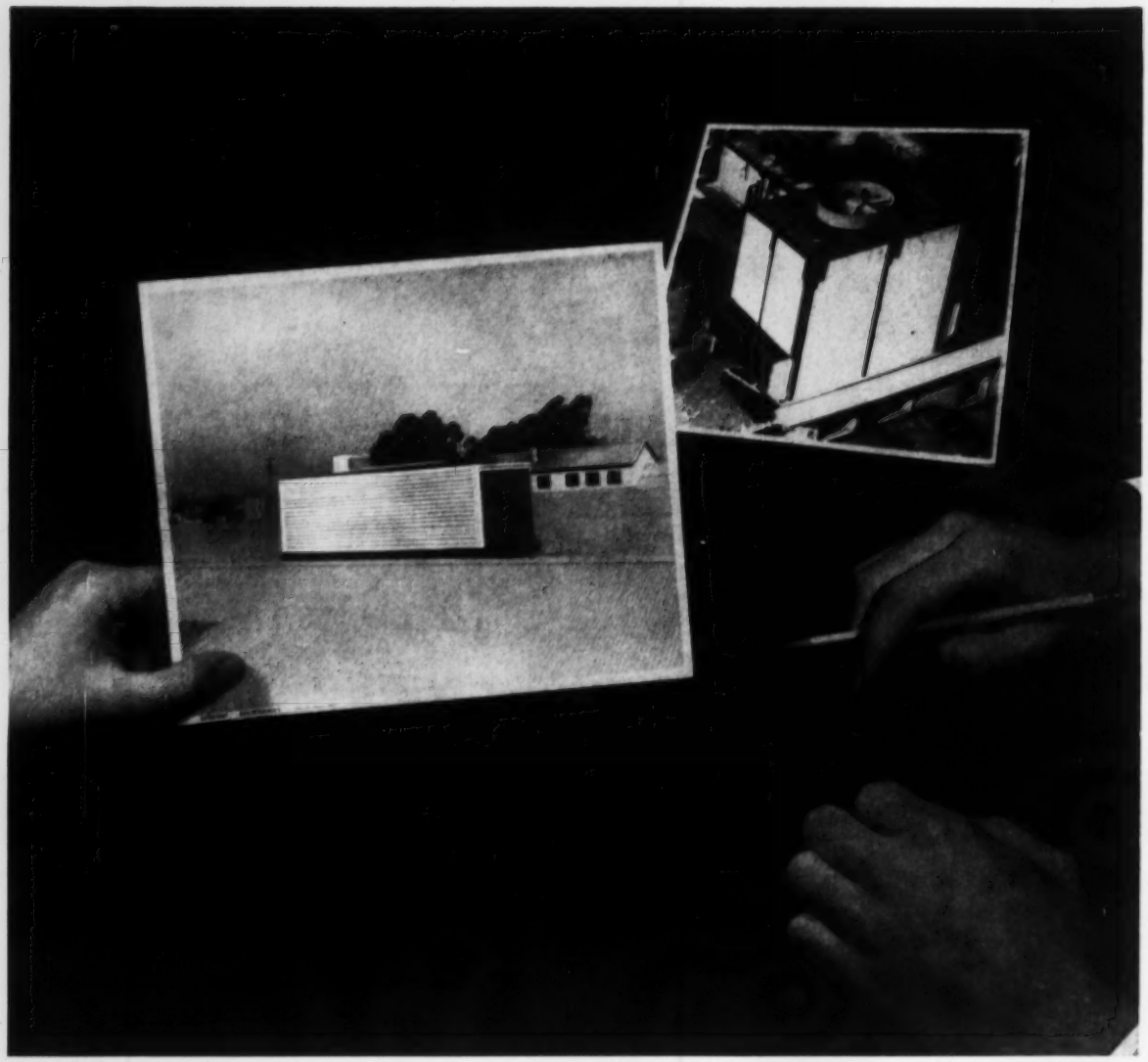
Your USG distributor has in stock, or can get for you, any quantity of any of the 50,000 gauges made by USG for all types of installations.

Write us for the name of the distributor in your area.

USG **UNITED STATES GAUGE**

Home of the **SUPERGAUGE**

Division of American Machine and Metals, Inc.
Sellersville, Pa.



"There's just no comparison! This Pritchard LoLine answers our design problem!"

"When you said it had a low silhouette, you really meant *low!*"

"That's why we chose this Pritchard LoLine tower. You know, cooling towers have always been a problem to architects. We design a good looking building and then have to clutter up the design by putting a tall and unsightly tower on top of it."

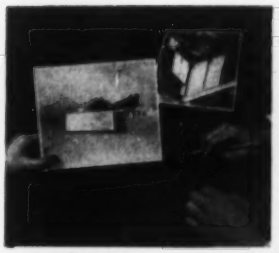
"Well, this LoLine ought to make you fellows happy!"

"It makes everyone happy. The engineers like it because it's efficient, has an internal piping system and a performance record that can't be beat. The owners of the building are happy because of the low initial costs and the minimum maintenance."

"It looks like the Pritchard LoLine is the answer to a lot of cooling tower problems."

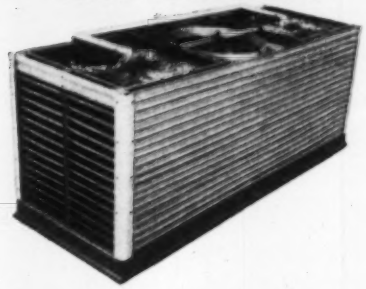
"It is! Whenever there's a problem, you can always count on Pritchard to come up with an answer!"

J. F. PRITCHARD & CO. OF CALIFORNIA
4625 Roanoke Parkway, Kansas City 12, Mo.



"There's just no comparison! This Pritchard LoLine answers our design problem!"

Seven good reasons for choosing the LOLINE®



Pritchard LoLine Cooling Towers are better in seven important ways:

1. They have the lowest silhouette of any tower 75 tons and up. Over-all height is just 7' 7 11/16".
2. *Galvanized* steel fan drive supports and basin accessories; not cheap, less durable, painted steel.
3. Grease fittings for the V-belt drive bearings are brought to the outside of the tower. Greater safety, easier maintenance.
4. *Corrugated* asbestos cement board casing; not flat asbestos cement board sheets.
5. Asbestos cement board louvers are installed as standard, not special equipment.
6. Optional internal pipe supply system. Permits complete concealment of piping.
7. V-belt drive features a stainless steel fan shaft for far longer life.

WRITE FOR LOLINE BULLETIN

Send for bulletin No. 5.1.902. Tells you all about the framework and mechanical equipment, capacities, optional equipment, name and address of Pritchard sales office nearest you. Write for your complimentary copy today on your company letterhead!

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J.F. Pritchard & Co.
OF CALIFORNIA
A DIVISION OF J. F. PRITCHARD & CO.
Dept. 509, 4625 Roanoke Parkway
Kansas City 12, Mo.

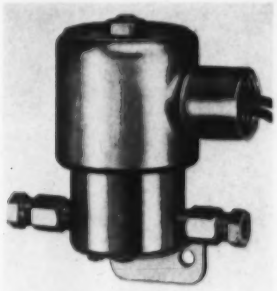
COOLING TOWERS • GAS & AIR TREATING EQUIPMENT
REPRESENTATIVES IN PRINCIPAL CITIES FROM COAST TO COAST

EQUIPMENT DEVELOPMENTS

Continued

3603 *Filbert St., Philadelphia* 1.

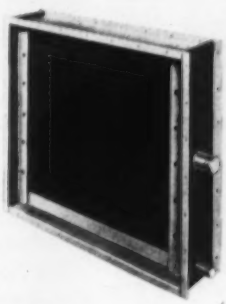
Adding 1/64 in. film or coating to flange faces, gasket surfaces reduces vacuum line leakage to minimum, says company. In two formulations—one for air, steam, water, mild chemicals; other for gasoline, oil, solvents, etc.



Air Valve . . .

. . . designed for quiet service—*Powers Regulator Co., Dept. HPAC, 3434 Oakton St., Skokie, Ill.*

Closely held spring, armature, guide, and material tolerances prevent a-c hum, other noise usually present in such controls, says company. Recommended by manufacturer for control of air conditioning damper motors, pneumatic motors and valves on industrial equipment.



Steam Coils . . .

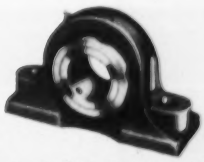
. . . designed with special tilted feature for drainage of condensate, whether used for vertical or horizontal air flow—*Rempe Co., Dept. HPAC, 340 N. Sacramento Blvd., Chicago* 12.

Heavy duty, distributor type coils have cover pieces at header and stub ends perforated to allow passage of

DODGE PRODUCTS You Should Know-

BRONZOIL BEARINGS

SLEEVOIL BEARINGS



SC & SCM BEARINGS

Dodge Bulletins you should have-

- ☒ Bronzoil Self Oiling Bearings. Dimensions and selection data.
- ☒ Sleevoil Bearings. Dimensions and selection data on plain and water-cooled types. Bulletin A-401-C.
- ☒ Rolling Bearings. Load ratings, dimensions and other data on SC and SCM Ball Bearings and Dodge-Timken Roller Bearings. Bulletin A-638.

Write for your copies.

DODGE
of Mishawaka, Ind.
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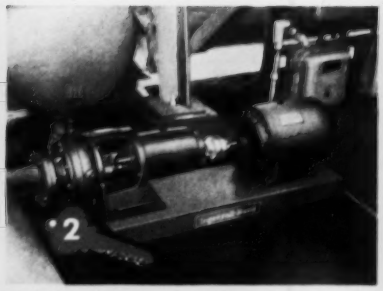
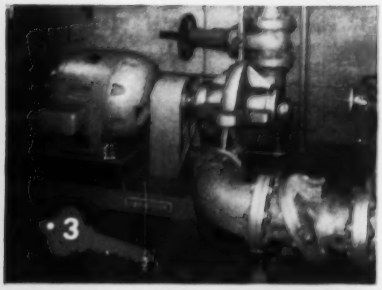
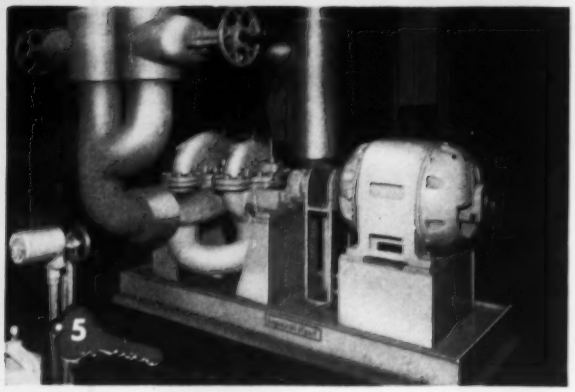






Five Keys to LONG-RANGE ECONOMY on your general-purpose pumping jobs

The Ingersoll-Rand pumps shown feature several different designs and types. Yet they all have one thing in common—the ability to give you low-cost performance on your general purpose pumping jobs.

When you install an I-R pump, you can count on continued efficient operation—with a minimum of time out for attention and maintenance.

In addition to the pumps shown, Ingersoll-Rand manufactures a complete line of single and multi-stage pumps of horizontal and vertical design for every job application. See your I-R representative for full information on the pump which best meets your needs.

1. **MOTORPUMPS**: Free from base plates, couplings and alignment problems, I-R Motorpumps can be mounted in any position that gives the simplest, most economical installation. They are especially designed for continuous full load service, with a wide range of capacities from 5 to 1800 gpm and heads up to 600 ft. Available in single, two and four-stage units.

2. **CRADLE-MOUNTED PUMPS**: Built with separate pump and drive units, coupled and mounted on a sturdy base plate, I-R Cradle-Mounted Pumps come in one and two stages, with capacities from 5 to 2800 gpm and heads up to 525 ft. They can be equipped with any drive, and provide easier accessibility, over-sized bearings and greater accessibility.

3. **SINGLE-STAGE HORIZONTALLY-SPLIT PUMPS,** with double mechanical shaft seals: For capacities from 275 to 2400 gpm and heads to 350 ft., maintenance-free DMV and DHV pumps are provided with double mechanical shaft-seals and permanently lubricated sealed bearings. Troublesome stuffing box maintenance is eliminated, and bearings do not require any attention or lubrication throughout the life of the pump.

4. **SINGLE-STAGE HORIZONTALLY-SPLIT PUMPS,** conventional design: The Class AFV unit illustrated is typical of the standard I-R line of single-stage horizontally-split centrifugals, with capacities ranging from 25 to 50,000 gpm, and heads from 20 to 350 ft. Stuffing boxes are extra deep, and equipped with water seal cages. Any type of drive may be used.

5. **TWO-STAGE HORIZONTALLY-SPLIT PUMPS**: I-R two-stage Class GT pumps are available in capacities up to 2200 gpm for discharge heads up to 1050 ft. Outstanding performance is assured by such features as extra deep stuffing boxes, renewable shaft sleeves and wearing rings, carefully designed liquid passages and volutes, and efficient closed-type impellers.

Ingersoll-Rand

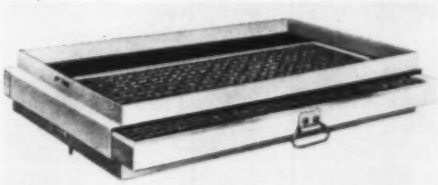
10-455 **11 Broadway, New York 4, N. Y.**

PUMPS • ROCK DRILLS • GAS & DIESEL ENGINES
COMPRESSORS • CONDENSERS • AIR & ELECTRIC TOOLS

EQUIPMENT DEVELOPMENTS

Continued

measured amount of bypass air, resulting in increased coil capacity, says company. Coils pitched in casing for full drainage to condensate outlet. Available with inlet, outlet on same or opposite ends.



Drawer-Type Filter Mounting . . .

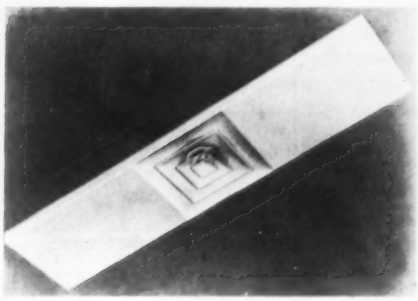
. . .added to company's line of ventilator accessories—*Trade-Wind Motorfans, Inc., Dept. HPAC, 7755 Paramount Ave., Rivera, Calif.*

Designed to provide easy-to-reach filters on all of manufacturer's centrifugal blower units installed in cabinet. Fits into filter unit while filter unit in turn fits hole in bottom of cabinet. Aluminum which forms drawer is reached by opening cabinet door, pulling it out. Filter cleanable in soap and water.

Portable Rotary Air Compressor . . .

. . .in new 85 cfm size added to company's "Gyro-Flo" line—*Ingersoll-Rand Co., Dept. HPAC, 11 Broadway, New York 4.*

Line now in six sizes 85 to 900 cfm. Unit equipped with tool boxes, fenders, two-wheel spring mounted running gear. Lightweight, compact design of unit also makes it ideal for truck mounting, says company.



Modular Ceiling Panel-Diffuser . . .

. . .for use with "Acousti Line Pan" ceilings, "Security Panel" ceilings, similar arrangements—*Anemostat Corp. of America, Dept. HPAC, 10 E. 39th St., New York 16.*

Designed to facilitate changes in air distribution requirements, allow distribution system to be fully integrated with ceiling design. Can be used in octopus distribution system, in which supply air is fed to attenuator chamber at high velocities, distributed at low

ATER LINE CONTROL...
Remember
rust and scale
won't clog
or jam
THIS
J-E
SOLENOID VALVE!
Even dirty water doesn't bother this J-E Solenoid Valve. There is no place for foreign matter to cause trouble . . . no metal-to-metal contact . . . just two moving parts (a stainless steel plunger and a flexible diaphragm). The flexible synthetic diaphragm literally "shrugs" off rust and scale...and is free floating to give you better flow with less pressure drop.
For all kinds of fluid control, J-E Solenoids guarantee you:
QUIET OPERATION . . . no mechanical linkage or impact action
DEPENDABILITY . . . tight seating, yet no chance for jamming or clogging
EASY MAINTENANCE . . . only two moving parts . . . cool-operating coils . . . one size coil and one plunger fit all valves
SIMPLE INSTALLATION...can be installed in any position.
CALL YOUR WHOLESALER . . .
or write us today!
VANS MANUFACTURING CO.
7 Geraldine Avenue • St. Louis 15, Mo.

Now—a Complete Line of R-P&C Solder End Valves

BRONZE GATES, GLOBES, CHECKS

• Now you can get R-P&C solder end valves similar to the **Fig. 90 gate valve** above in globe valve and check valve styles. They have been especially developed for use with K, L or M copper tubing on hot and cold water, or low pressure steam lines in plumbing, heating and air conditioning systems.

All are rated for 125 lbs. in steam service, or 200 lbs. with oil, water or gas. Gates are provided in sizes from ⅜" to 3", globes from ¼" to 2", checks from ⅜" to 2".

FREE SLIDE RULE

Valve selector slide rule gives all dimensions for iron body and steel valves in pressure classes from 150 to 1500 lbs. Write for yours.

These new valves reflect the quality construction features, typical of the complete R-P&C line, which result in longer life, lower maintenance and easier installation. They are presented in a wide range of styles—for example, the gate valves are supplied with either rising or stationary stem, and solid or split wedge. Each valve is hydrostatically tested at a pressure of 350 pounds before leaving the factory.

Your R-P&C distributor has these valves in stock now—or he can get them for you. Write Reading office for complete catalog.

ACCO

R-P&C Valve Division
AMERICAN CHAIN & CABLE

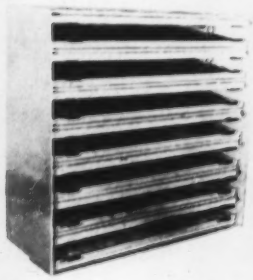
Reading, Pa., Atlanta, Boston, Chicago, Denver, Detroit, Houston, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

R-P&C valves

EQUIPMENT DEVELOPMENTS

Continued

velocities through flexible metal tubes to as many as four ceiling diffusers. Available in 12 × 24, 12 × 48 in. panels.



Air Filter . . .

. . . with dry type, renewable media—*American Air Filter Co., Inc., Dept. HPAC, 215 Central Ave., Louisville 8.*

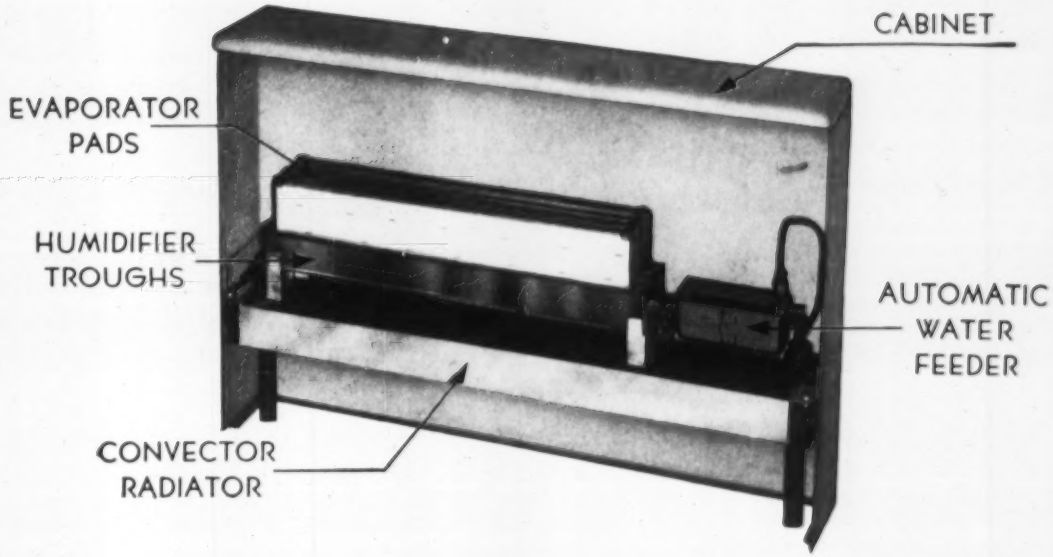
"Multi-Pak" designed for operating in chemical plants; pharmaceutical laboratories; film, optical, electronics plants; atomic energy installations, other specialized fields. Dry type unit developed for those applications that require air filters of standard construction but need higher than normal efficiency, says company.

Molded Insulation . . .

. . . for use on steam, heated process piping—*Keasbey & Mattison Co., Dept. HPAC, Ambler, Pa.*

Low conductivity insulation is said to withstand pipe temperatures to 1350 F. "Kaytherm," produced in half-cylindrical sections and segments 36 in. long, installed by encircling metal bands to fasten two mating sections to pipe. In thicknesses 1 to 4 in. Will accommodate pipes to 33 in. in diameter.

NOW! AUTOMATIC HUMIDIFIERS FOR CONVECTOR RADIATORS



The only automatic humidifier on the market made especially for modern convector radiators

BIG FEATURES

- Only 3⅜ inches deep. Fits even the extremely shallow convector cabinets.
- Water is supplied directly to feeder from the convector on hot water systems. On steam installations, water is taken from nearest supply through copper tubing.
- Completely automatic. Float-controlled valve keeps water line constant.

BIG PERFORMANCE

- Maximum evaporating area. Unique design of water troughs makes every inch of this humidifier a working surface which creates more evaporating area.
- Minimum air restriction. The separate, narrow ⅜ inch troughs which hold the evaporator pads are spaced to allow free flow of heated air between the pads and on all sides of unit.

Available in both 2 and 4 trough units in 10 different sizes.

The new Maid-O'-Mist Convector Humidifiers are made in evaporating capacities of 1 to 5 gallons per day. Construction throughout is of non-ferrous metal. Easy to install. Get full information from your jobber or write us direct for complete details.

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HEATING SPECIALTIES

AUTOMATIC HUMIDIFIERS . . . . . AUTO-VENTS
WATER LINE CONTROLS . HEATING SPECIALTIES

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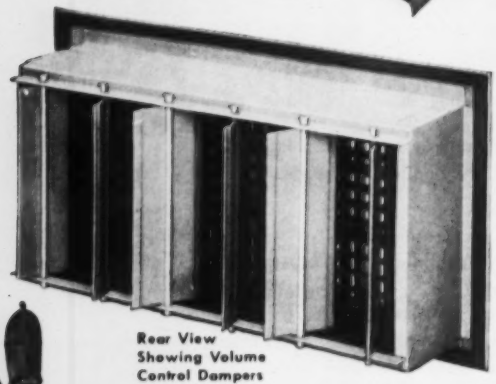
INDEPENDENT

"Fabricated"

DOUBLE CORE REGISTERS
with opposed blade dampers
key control
For Commercial Installations

No. 27
Adjustable Vertical Front Bars
Adjustable Horizontal Rear Bars



Rear View
Showing Volume
Control Dampers

Write for Catalog
No. 56 which gives
complete details and sizes
up to 48" x 24"

Always Leading—
Always Progressing

THE INDEPENDENT REGISTER CO.
3747 E. 93rd STREET · CLEVELAND, OHIO

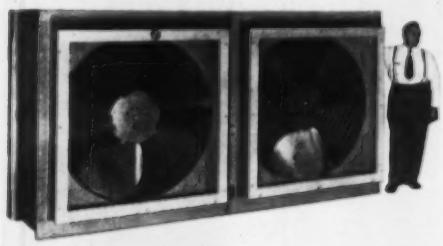
EQUIPMENT DEVELOPMENTS

Continued

Cabinet Unit Heater . . .

. . .engineered to feature unit heater volume capacity, coupled with console cabinet design—*Fedders-Quigan Corp., Dept. HPAC, Lalor and Hancock Sts., Trenton, N. J.*

Recommended by company for installation in lobbies, gymnasiums, auditoriums, offices, churches, other large area hard-to-heat structures. May be installed free standing, semi-recessed, recessed, wall or ceiling hung. Designed to deliver to 117,300 Btu per hr.



Air Cooled Condenser . . .

. . .designed to eliminate water problems—*Refrigeration Appliances, Inc., Dept. HPAC, 923 W. Lake St., Chicago.*

Remote type, fluorinated hydrocarbon refrigerant unit available in sizes 1 to 30 tons, operates on nominal ratings based on 110 F condensing temperature. Air is drawn through coil on counterflow principle, providing more even distribution of air and making for more efficient use of condenser coil surface, says company.

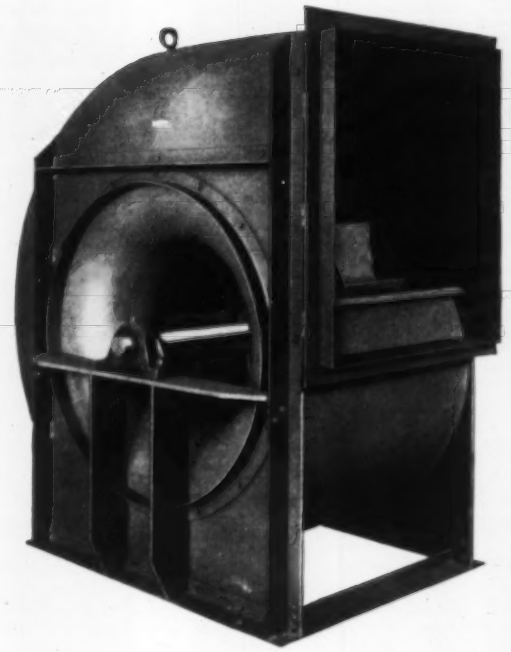
Electric Clock Thermostat . . .

. . .restyled to complement interior decorating schemes—*Minneapolis-Honeywell Regulator Co., Dept. HPAC, 2641 Fourth Ave., S., Minneapolis 8.*

Has gold body, clear plastic covered white face. Internal components unchanged. However, mercury thermometers for temperature indication have been replaced with coiled bimetal element said to be more precise and actuating a slim pointer.

nyb centrifugal fans...

STANDARD AND HEAVY DUTY



Skillfully Engineered, Accurately Rated, Feature Heavy Welded Steel Construction

Two types of fan wheels. Housing dimensions remain the same but performance characteristics differ.

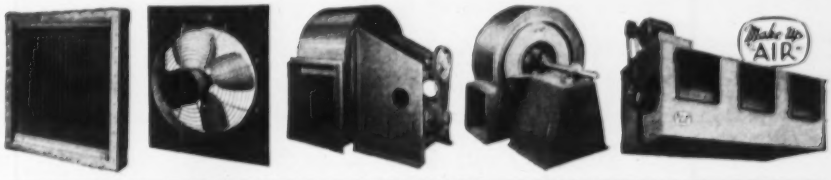
Forward Curve wheels offered from 7½ to 73 inch. Capacities up to 70,000 cfm.

Quiet operating, medium speed (IPL) wheels with non-overloading horsepower characteristics for heating, ventilating and air conditioning or industrial applications. Wheel diameters from 15 inch to 73 inch, with any speed or discharge required. Capacities up to 123,000 cfm. Class I, II, or III construction.

All-welded housing featured as standard construction for simplicity, extra strength and rigidity—dust tight and leak proof. Bolted (knock-down) type available in Class I and Class II. Split housing can be furnished as extra if required.

Write for Bulletins 544 and 561

nyb products have 65 years of manufacturing experience and engineering knowledge built into them. All ***nyb*** products are laboratory tested, accurately rated and fully guaranteed in strict accordance with standard test codes.



When working on your air handling problems, consult the *nyb* representative nearest you in our nationwide service or write for bulletins.

nyb THE NEW YORK BLOWER COMPANY

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FACTORY, LAPORTE, INDIANA

If you can reach it, you can fasten it with *Ramset*®

One-hand operation in awkward places is simple with a light RAMSET powder-actuated tool. It's ideal for ladder and scaffold work.

For anchoring to concrete or steel, the new DUO-JOBMASTER® sets ¼" and ⅜" fasteners interchangeably—merely by switching barrels right on the job! Yet the tool does not change size or weight!

There's no need to exert physical power when you use RAMSET. Let the power charge do the work! No wires, no hose to drag or untangle. RAMSET is entirely self-contained.

Tough jobs are now easy with RAMSET. No more drilling, filling, plugging and bolting. RAMSET fasteners are set at the press of the trigger—have greater holding power than old-style methods.

Speed your production, make work easier for operators, cut your costs, get more dependable performance by using RAMSET whenever fastening to concrete, steel or other hard materials.

Write for free new catalog, ready for you now.

companion tool

Shure-Set
TRADEMARK

Baby brother to RAMSET, this hammer-in tool uses no cartridge, but makes your own hammer power more effective. For masonry, mortar joints, cinder block. Ask for literature.

Ramset Fastening System
WINCHESTER-WESTERN DIVISION
OLIN MATHIESON CHEMICAL CORPORATION
12109-K BEREA ROAD • CLEVELAND 11, OHIO

EQUIPMENT DEVELOPMENTS

Continued

Steam Trap . .

. . .for unit heaters, small processing machinery, like applications—*Perfecting Service Co., Dept. HPAC, 332 Atando Ave., Charlotte 6, N.C.*

Lightweight, bucket type unit available in ½ in. pipe size with universal pressure range zero to 125 psi. Developed for low pressure-high condensate rate applications where smaller, inexpensive trapping unit needed. Also available in larger sizes to 2 in.

Equipment Briefs . . .

FIBROUS INSULATING material made from basalt volcanic rock—*Thermo-Sound Products, Div. of Kittell-Lacy, Inc., Dept. HPAC, 10816 E. Faucett Ave., El Monte, Calif.* "Basaltwool" is said to have good acoustical properties, withstand extreme heat, need no binder, have long life.

SCREW DRIVER with portable, electric design—*Black & Decker Mfg. Co., Dept. HPAC, 628 Pennsylvania Ave., Towson 4, Md.* New "No. 10" adjustable and positive clutch "Scruguns" added to company's line. Feature of new unit is pistol grip trigger switch.

FORMING, FINISHING tool designed for all types of surfaces—*Stanley Tools, Div. of Stanley Works, Dept. HPAC, New Britain, Conn.* Is said to work fast on all materials up to hardness of mild steel, including wood, fiber board, plastics, copper, aluminum, lead, other metals.

"We place our confidence in the performance of American Vibration Eliminators . . ."

reports JOE HOPPE, Inc., Dallas, Texas

SERVICE REPRESENTATIVE A. C. Lewis examines 2⅝" American VE used on hot gas line. 2⅛" VE's on the suction line handle the cold gas—thus VE's reduce vibration and noise on both sides of unit.

"In the system we recently installed at Gulf Industries, Inc., (manufacturers of aircraft parts) Grand Prairie, Texas, gas is compressed from a 4" expansion to a 2" compaction. Without American VE protection, the rigid pipe lines in the system, especially those near motors and compressors, would have no give . . . connecting joints would break and leak . . . costly refrigerant would be lost . . . and vibration would cause nerve-racking noise.

"Since their installation, American VE's have performed their job in their *usual* efficient way . . . making the entire system tight. In fact, we've used American VE's for the past 6 years and we've never seen one fail to function properly. The tougher the job, the greater the reason to use *American* VE's, we say."

You can use AMERICAN VE's with confidence because—

The right metal does the job. The special tin-bronze alloy—the result of American Brass metallurgical know-how—is tailored for the refrigeration and air conditioning industries.

Double braid where extra protection is needed. On all American VE's 2⅝" O.D. and larger.

Clean, dry, tested, protected. Snip the end of the vapor-proof polyethylene bag and you have a factory-fresh unit to install in the line . . . clean, inside and out!

Packaged for your convenience, protection. The new boxes are sturdy, easy to open, easy to identify. Insist on VE's with the stamping "American" on the ferrule . . . an Anaconda product.

NOW LISTED BY UNDERWRITERS' LABORATORIES THROUGH SIZES 3⅝" O.D.

FOR DESCRIPTIVE FOLDER WRITE: The American Brass Co., American Metal Hose Division, Waterbury 20, Conn. In Canada: The Canadian Fairbanks-Morse Co., Ltd.

WHEREVER CONNECTORS MUST MOVE

AMERICAN

For American Vibration Eliminators see your

ANACONDA®

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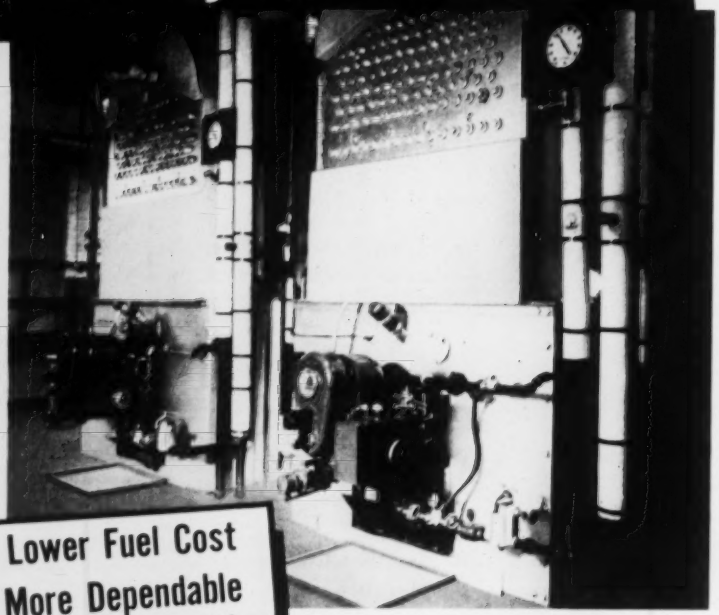
Why It PAYS to Install PREFERRED *Rotary* Heavy-Oil Burners



Lower Fuel Cost
More Dependable Automatic Operation
Less Maintenance

Preferred Burners firing #6 oil into two water tube boilers, each 20,000 lbs. steam capacity, at Henry Barnard School, New Rochelle, N. Y.

In this typical installation, oil firing with Preferred Burners has resulted in

1—Raising combustion efficiency from 62 to 81 per cent.
2—Reduction in fuel cost by 26.5 per cent.
3—Practically automatic operation and elimination of manual labor.
4—A boiler room as clean as the classrooms.

In the boilers shown, with the adaptation of existing combustion systems and the application of Preferred Oil Burners and automatic control, two old coal-fired boilers were brought up to modern heating standards. In the four years since conversion there have been no emergency shutdowns.

Whether in converting coal-fired boilers or for inclusion in modern, automatic, oil- or gas-fired boilers, Preferred Horizontal Rotary Burners have established an enviable record of dependable, economical performance.

This is literally true of thousands of Preferred Burner installations in commercial, industrial and institutional establishments. Learn how it pays to get better heating results with Preferred. Write for Bulletin 175.

PREFERRED UTILITIES MFG. CORP.
1860 BROADWAY DEPT. HP NEW YORK 23, N. Y.

EQUIPMENT DEVELOPMENTS

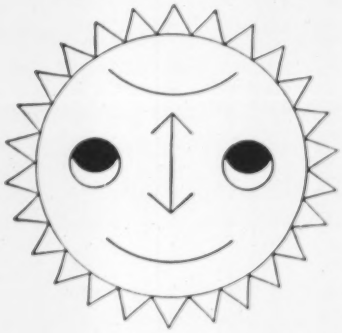
Continued

SOLDER FLUXES designed for use on copper, copper base alloys—*Federated Metals Div., American Smelting and Refining Co., Dept. HPAC, 120 Broadway, New York 5.* Are said to be noncorrosive, quick wetting. Utilize safe-to-handle derivatives of hydrazine, says company.

ADHESIVE TAPE treated to give additional strength—*Spring Packing Corp., Dept. HPAC, 332 S. Michigan Ave., Chicago 4.* Felt tape coated with "extra-powerful" pressure sensitive adhesive. Formulated to seal against dust, dirt, wind, fumes, moisture.

COLD GALVANIZING COMPOUND for repairing damaged galvanized surfaces—*American Solder and Flux Co., Dept. HPAC, 19th and Willard Sts., Philadelphia.* Designed

The tragic fact, our doctors tell us, is that every third cancer death is a needless death... *twice* as many could be saved.



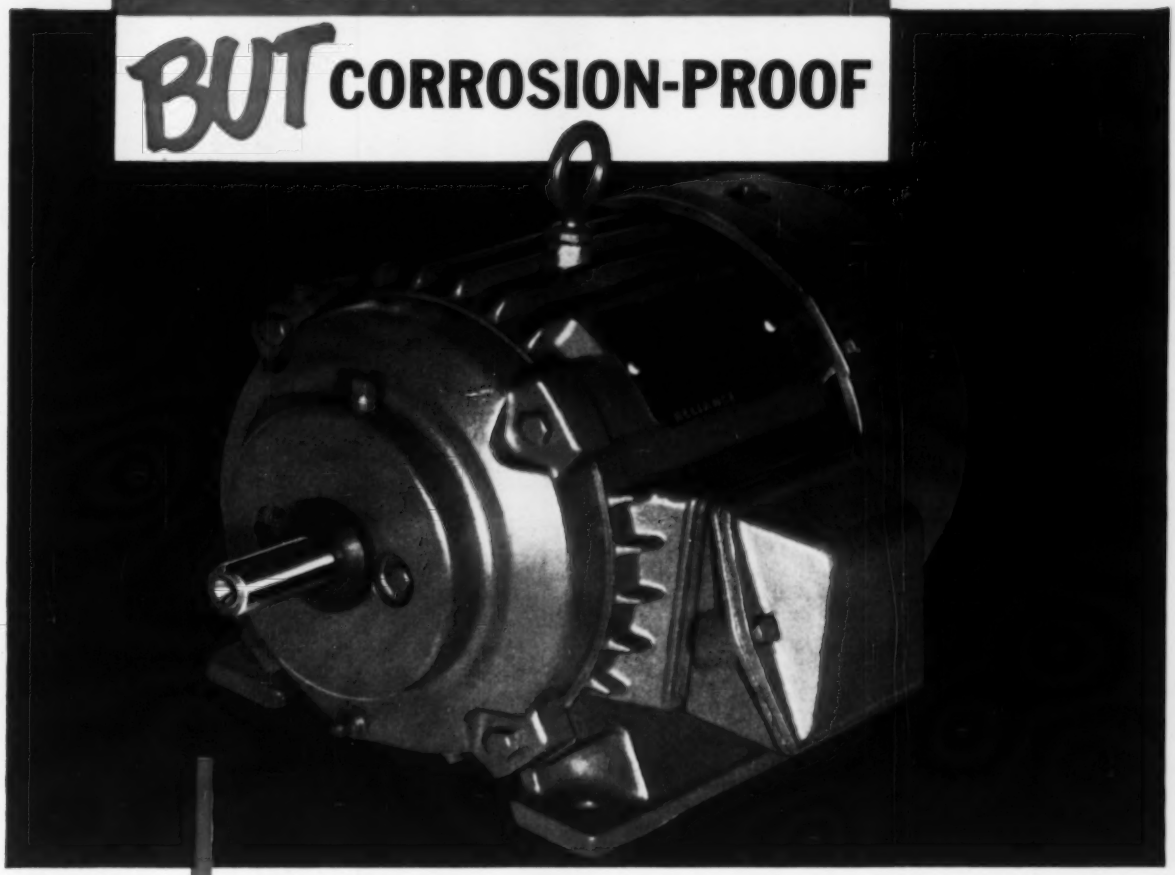
LET'S LOOK AT THE BRIGHTER SIDE

Many thousands of Americans are cured of cancer every year. More and more people are going to their doctors *in time*...To learn how to head off cancer, call the American Cancer Society or write to "Cancer" in care of your local Post Office.

American Cancer Society

Not Just CORROSION-RESISTANT

BUT CORROSION-PROOF



Corrosion resistance is not enough to stop acids or alkalies from chewing up a motor in a hurry. That is why the wise engineer selects Reliance Corrosion-Proof Motors for corrosive service.

These motors are built to withstand the onslaught of destructive chemicals for years. Housings are made of virtually indestructible cast iron. Exterior contours are designed to slough off liquids—no nooks and crannies to retain corrosive elements. Enclosures are sealed to prevent any leakage . . . Metermatic lubrication systems provide complete protection against burned out bearings and contaminated lubricants.

Anyway you look at them, Reliance Corrosion-Proof Motors can take it—and you're not limited in the choice of motors either. A complete line of a-c. motors, 1 thru 300 hp., is available in all mountings, frequencies and voltages.

Why not call your Reliance representative today and get all the details.

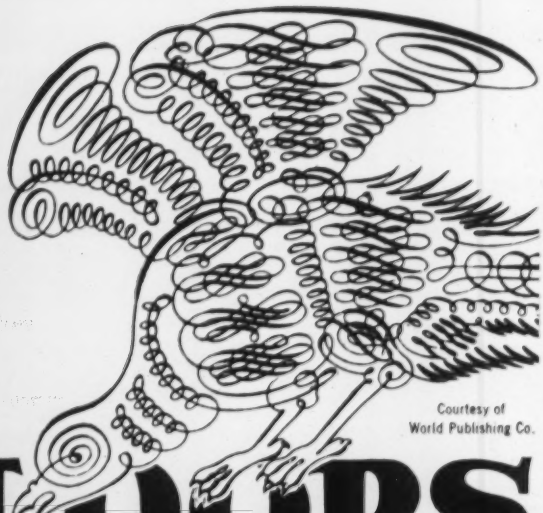
B 1555

RELIANCE *Totally-Protected* MOTORS

RELIANCE ELECTRIC AND ENGINEERING CO.

Dept. 3611A, Cleveland 10, Ohio • Offices in Principal Cities

Canadian Division: Welland, Ontario



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LOOPS are for the birds -

Bending a line into loops to decorate documents became a highly developed art form in 17th Century England.

Bending a line into loops to absorb compressor vibration was accepted practice for years in our AIR CONDITIONING and REFRIGERATION INDUSTRY.

BUT—as equipment was improved installations grew smaller and engineers discovered that flexible hose absorbed this vibration in far less space and with far greater efficiency than any other method devised.

PACKLESS® Vibration Absorbers

absorbs *more* vibration in *less* space by spirally corrugating the wall of seamless drawn tubing, allowing fluid or gas to follow a direct course while absorbing vibration en route.

One piece, leak tite construction provides long service under rough conditions where welded or crimped construction fails (and must be replaced).

Available for pressures to 15,000 lbs., in stainless or carbon steel, and bronze. Standard or special fittings as required.

Consultation and design engineering for *your* specific requirements offered at no extra cost.

SEND NOW

for your copy of Bulletin VA-3 or contact us direct. Your inquiries will receive immediate attention.

PACKLESS METAL HOSE INC.

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EQUIPMENT DEVELOPMENTS

Continued

to provide rust protection, prevent corrosion. Applied like paint with brush or spray gun.

BLIND RIVET for sheet metal work, metal building assembly in plant—*Huck Mfg. Co., Dept. HPAC, 2480 Bellevue Ave., Detroit.* Comprised of hard aluminum pin with five cutting edges, hard aluminum sleeve with large or small washer flange.

ALUMINUM COIL-ACCUMULATOR, CONNECTOR ASSEMBLY for refrigeration manufacturers—*Wolverine Tube, Div. of Calumet & Hecla, Inc., Dept. HPAC, Guardian Bldg., Detroit* 26. Tubular assembly includes aluminum accumulator, bunch type aluminum coil, aluminum-to-copper connectors. Specifically designed for evaporator unit, assembly is said to simplify material handling, short-cut welding and assembly installations. ∓

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VENTILATION

HANDBOOK

A practical manual on fume removal, dust collecting, ventilating and exhaust systems for industrial plants. Tells how to design correctly and provide for various ventilation requirements . . . make measurements and analyses of fumes, mists and dusts . . . plan exhaust systems, etc. Twenty eminent authorities contributed also to detailed descriptions of systems in actual operation in many plants, whatever the manufacturing process. 154 pages of practical "know-how" reprinted from HP&AC. Send your order with only $1.50 ($1.75 foreign) to get it postpaid from

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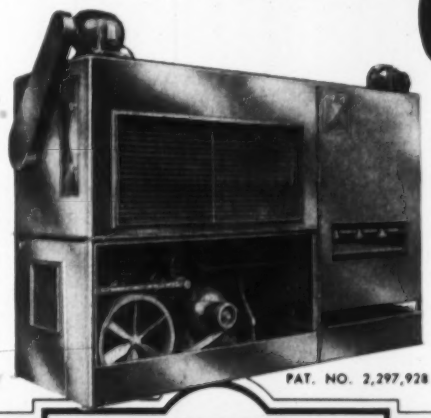
Of unusual loads or space requirements are your problem...



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Governair, originators of completely packaged air conditioners, offers you the installation advantage of compact, all-in-one design *combined* with manufacturing flexibility that provides the answer to unusual space and load problems.

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AIR CONDITIONERS

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Nesbitt
INDUSTRIAL UNIT HEATERS

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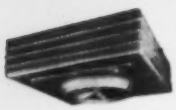
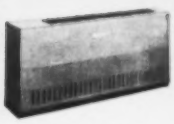


LITTLE GIANT UNIT HEATERS



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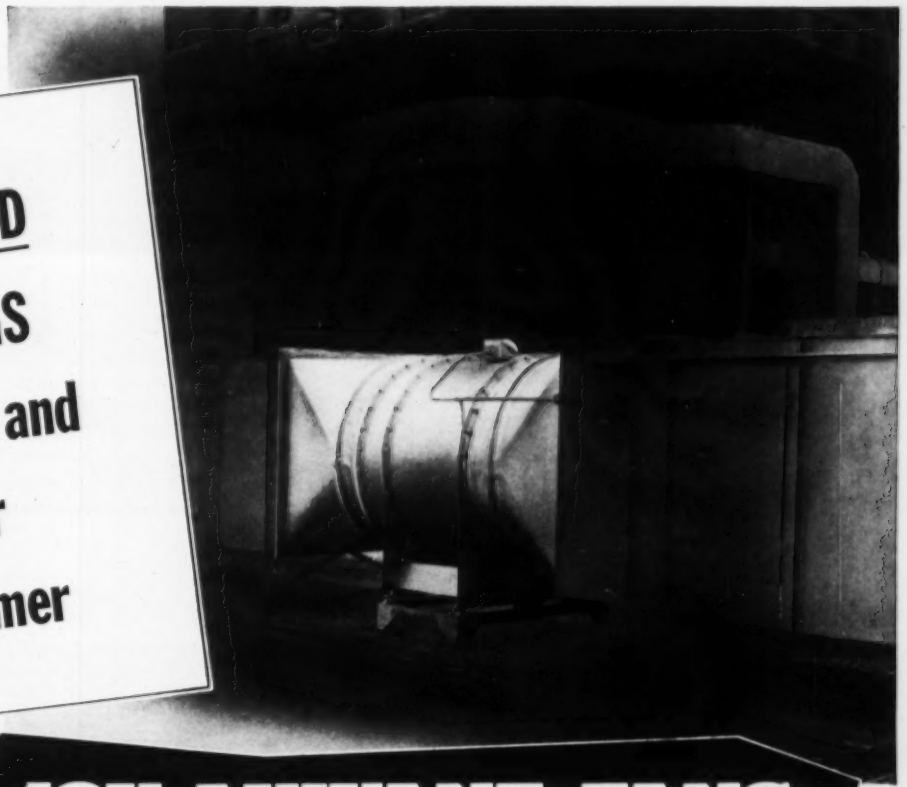
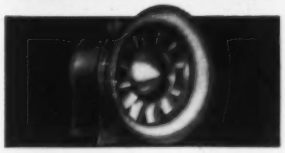
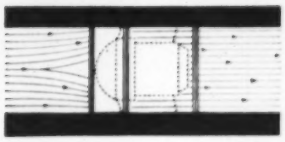


with JOY AXIVANE FANS





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for VANEAXIAL FANS • COMPRESSORS • OXYGEN GENERATORS
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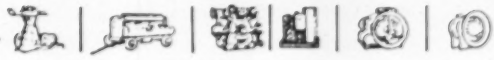

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Fig. 427
Standard 125-lb. S.W.P. Bronze Gate, Non-Rising Stem, Inside Screw, Wedge Disc, Screwed Ends.

Fig. 427BS
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PISTOL-GRIP HANDWHEEL . . . non-heating malleable iron, provides firm, easy three-way grip on top, sides and bottom. Indented rim notches top, side and bottom eliminate slip even with greasy gloves.

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RECENT TRADE LITERATURE . . .

▸ *AIR CONDITIONERS* — Fan and coil room air conditioners for year 'round air conditioning of hotels, office buildings, hospitals, schools, other multistory buildings described in 4 page bulletin No. C-1100-B88P. Special features described. Dimensional drawings, rating and specification tables included. *Worthington Corp., Dept. HPAC, Harrison, N.J.*

▸ *BACK DRAFT DAMPERS* — New 4 page bulletin BD-56 gives information on complete line of back draft dampers designed to have quiet, sensitive, nonmetallic blades. Units recommended by company for installation in schools, churches, auditoriums, theaters, office and public buildings. *Rittling Corp., Dept. HPAC, Rittling Bldg., Buffalo 5.*

▸ *BATCH CONTROL* — Catalog 91-109 describes company's batch control systems. Systems are designed to offer simple, dependable means for "automatically" adding predetermined volume of fluid to batch process. *Fischer & Porter Co., Dept. HPAC, Hatboro, Pa.*

▸ *BLAST COIL HEATERS* — Bulletin E-97P on electric blast coil heaters for packaged air conditioners contains general description, construction details, pressure drop curves, how-to-order information, specifications. Also covers magnetic contactors, thermostats. *Industrial Engineering and Equipment Co., Dept. HPAC, 24 Hanley Industrial Court, St. Louis 17.*

▸ *BOILERS* — New line of cast iron "Oilmaster 56" boilers for small commercial applications described in 4 page brochure. Visualizes design, construction features with cutaway drawings, photographs. *Thatcher Furnace Co., Dept. HPAC, Garwood, N.J.*

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- Rugged ... dependable ... economical Reducer meets all AGMA standards.

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FUEL OIL HEATER

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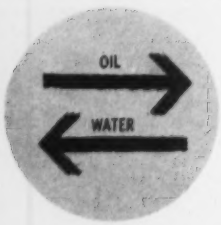

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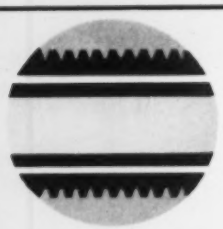
Safety-barrier — Heat transfer liquid between tubes eliminates all need for electric warning systems.



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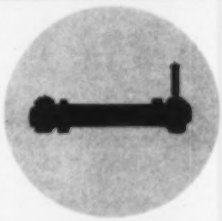

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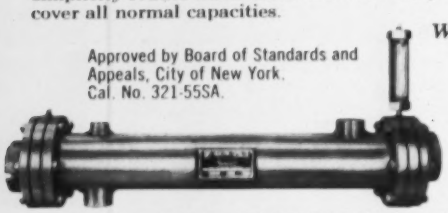

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RECENT TRADE LITERATURE

Continued

▸ *CAPILLARY TUBE* — Leaflet on "Capilator" covers advantages of plug-drawn unit for metering flow of liquids, gases. Highlights testing, control features. *Wolverine Tube, Divs. of Calumet & Hecla, Inc., Dept. HPAC, Guardian Bldg., Detroit 26.*

▸ *CENTRIFUGAL FANS* — New "Airfoil" centrifugal fans designed for heavy duty industrial applications detailed in 8 page bulletin No. 1824. Literature discusses performance features, construction details. Includes photographs and drawings of wheel, housing, bearings, shaft, bearing supports, inlet screens. *American Blower Corp., Dept. HPAC, Detroit 32.*

▸ *CLAMPS FOR PLASTIC PIPE* — Application chart shows correct size clamp to be used with any given size, type of plastic pipe. Divided into two sections, one covers standard wall and 75 lb pipe, other covers heavy wall and 100 lb pipe. *Ideal Corp., Dept. HPAC, 435 Liberty Ave., Brooklyn 7.*

▸ *CONTROL PANELS* — File No. TD-111 details "Supervisory Data-Center" panels for heating, air conditioning. Company has also published 4 page folder illustrating, listing features of unit; showing buildings where centers installed. "Hotel/Motel Master" model of system described in 14 page booklet. *Minneapolis-Honeywell Regulator Co., Dept. HPAC, 2641 Fourth Ave., S., Minneapolis 8.*

▸ *CONTROLS* — Condensed catalog and price list B43-1 introduces company's new "ElectroniK" strip chart, circular chart and circular scale instruments. Also includes specifications, prices of vane-type millivoltmeter controllers, thermocouples, radiation detectors, remote bulb thermometer controllers, flame failure safeguards, limit controls, electric and pneumatic valves. *Minne-*

Precision Temperature Control at Your Command . . .

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Self-Actuated Vapor Pressure TEMPERATURE REGULATOR

Modern design and skilled craftsmanship are combined in the new Klipfel Golden Genie to assure accurate, positive, low cost temperature control.

Featuring strong, long-lasting 2-ply bellows, it operates at higher working pressure with smaller bulb, develops more power for valve actuation.

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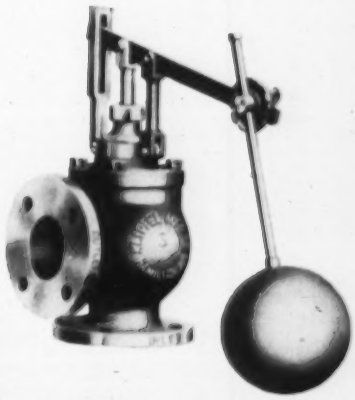

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- Really automatic liquid level control . . . proven by a 40-year record of dependability in thousands of installations, large and small, water and chemical.
- Direct acting or pilot control types . . . single or double seated . . . for every possible requirement of pressure, temperature, fluid and closure.
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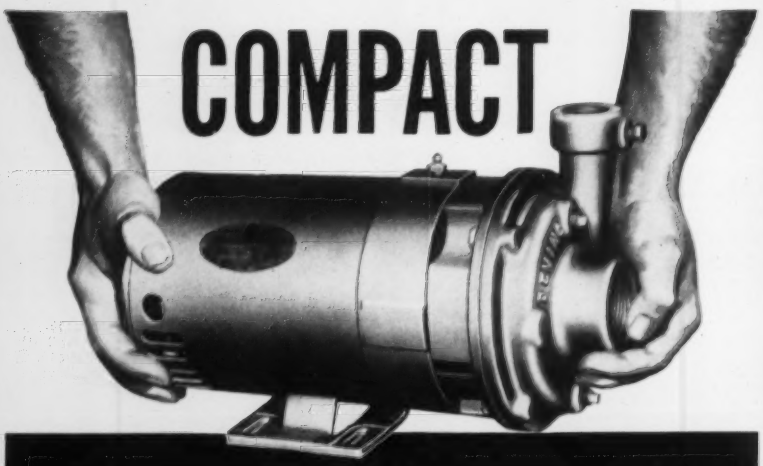
Export Dept. — 1010 Schaff Bldg., Philadelphia, Pa.



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Deming "Motor Mount" Pumps for AIR CONDITIONING

Designed for air conditioning service, these compact, dependable Deming "Motor-Mount" Centrifugal Pumps offer you high quality units at minimum cost.

Suction and discharge nozzles are integral with casing which may be turned to give either horizontal or vertical positions of the discharge nozzle.

Construction features include all-bronze, enclosed type impeller; stainless steel shaft; mechanical, rotary type shaft seal; and ball bearing, single or three phase motor equipped with grease lubrication for bearings.

Capacities range from 5 through 140 G.P.M. with heads from 10 through 140 feet at 3500 R.P.M.

In addition to air conditioning applications, these versatile pumps are also efficient units for booster service, general circulating service, swimming pools, lawn sprinkling and industrial plant service.

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CALL YOUR **DEMING DISTRIBUTOR** *for help on pumps!*

RECENT TRADE LITERATURE

Continued

apolis-Honeywell Regulator Co., Industrial Div., Dept. HPAC, Wayne and Windrim Aves., Philadelphia 44.

▸ *CONTROLS, VALVES, BOILER SAFETY DEVICES* — Condensed catalog and service guide contain information on company's line of boiler water level controls, relief valves, related boiler safety devices. Illustrations, descriptions, specification tables included. *McDonnell & Miller, Inc., Dept. HPAC, 3500 N. Spaulding Ave., Chicago 18.*

▸ *COOLING* — New 48 page cooling manual contains basic information to aid mechanical (heating, piping, air conditioning) contractor. Publication has section on commercial installations, in addition to fundamental information. $1.00 per copy. *International Heater Co., Dept. HPAC, 101 Park Ave., Utica, N.Y.*

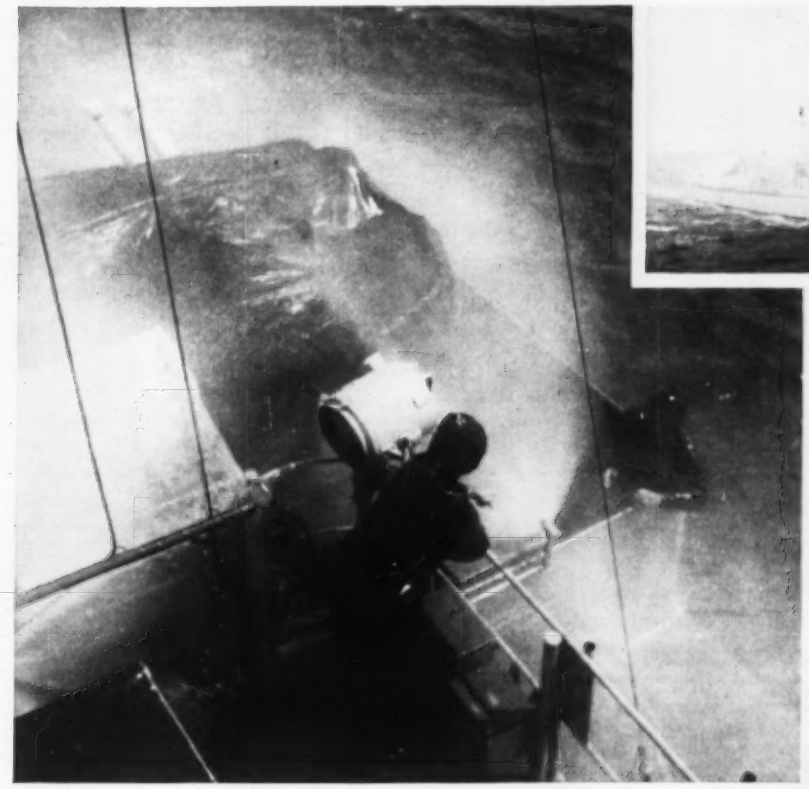
▸ *DEHUMIDIFIERS* — Type "SCZ" sprayed coil surface dehumidifiers in 241 sizes from 1000 to 60,000 cfm detailed in bulletin C-1100-B90. Units recommended by company for comfort cooling, industrial applications. Literature includes photographs, specifications, dimensional drawings, physical data tables. *Worthington Corp., Dept. HPAC, Harrison, N.J.*

▸ *DIFFUSERS* — Twelve page bulletin features new products added to company's line. Included in bulletin are remote manual control, ceiling panel-diffuser, straightline aspiration diffuser, high capacity vane type diffuser for high sidewall installation, diffusers for ceiling mounting with center induction and radial distribution, diffusers with air extraction in outer cones. *Anemostat Corp. of America, Dept. HPAC, 10 E. 39th St., New York 16.*

▸ *DIRECT FIRED HEATERS* — Folder No. 342 contains descriptions, illustrations, dimensional drawings,

Another new development using

B.F.Goodrich Chemical *raw materials*



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to wash away radioactive contamination

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First, metal piping was tried for the system—but it added too much weight. The answer was found in rigid vinyl plastic pipe, made of Geon polyvinyl materials. This piping weighs but one-fourth as much as metal. It's impervious to sea water's corrosive effects, unaffected by either freezing or tropical temperatures. And, using simple but strong solvent-welded joints, it's so easy to install that the ship's crew can do the job easily. The washdown system was developed by the U. S. Navy's Bureau of Ships. The Grinnell Company, Inc. was the principal contractor in this effort.

This is only one of the many applications of Geon polyvinyl materials, ranging from rigid products like ductwork to flexible products like upholstery, from coatings for textiles and metal, to foam for cushioning and crash padding. Investigate this remarkable material for *your* products.

For more information write Dept. DN-6, B. F. Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, O. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

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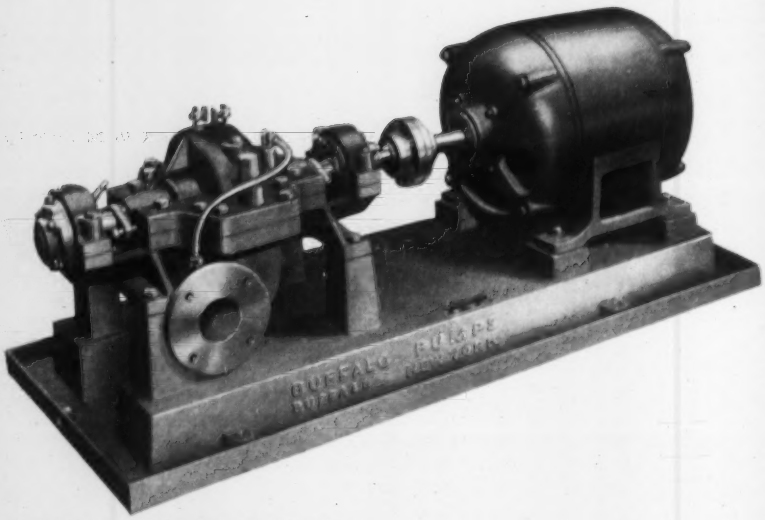

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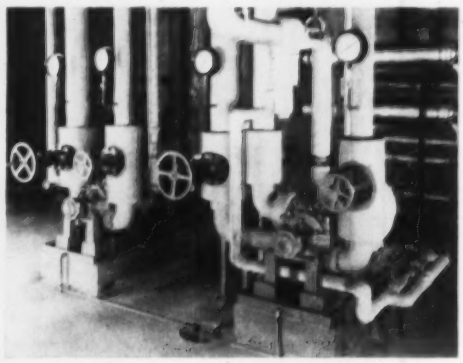
"MADE-TO-ORDER" for BOILER FEED!

These time-proved pumps are delivering clear water at high temperatures against pressures up to 500 psi — doing it efficiently and on a trouble-free basis. Consider a typical example — the 3" 2-stage "Buffalo" RR Pump delivering 400 gpm against 500 ft. head at 3500 rpm — an efficiency of 75%. Yes, these pumps are made-to-order for your boiler feed or other high pressure jobs. Bulletin 980 gives you all the engineering details and "Q" Factor* features that add up to satisfaction when you specify "Buffalo" for the job. Write for your copy today!



"Buffalo" Type RR Pumps giving efficient performance day in and day out in a large boiler installation where continued high pressure is vital.

*The "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.

"Buffalo" PUMPS

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A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

RECENT TRADE LITERATURE

Continued

engineering data for direct fired heaters for oil, gas, combination fuels. *Auto-Therm Mfg. Co., Dept. HPAC, Detroit* 34.

▸ *FITTINGS, FLANGES* — Bulletin FB-502 describes briefly line of carbon, alloy and stainless steel seamless welding fittings, forged steel flanges. *Babcock & Wilcox Co., Tubular Products Div., Dept. HPAC, Beaver Falls, Pa.*

▸ *FLOW METER* — Catalog describes function, construction, operation of electro-caloric flowmeter. Lists advantages. Cutaway drawing illustrates construction of smooth-bore flow cell. Diagram shows principles of operation. *Industrial Development Laboratories, Inc., Dept. HPAC, 17 Pollock Ave., Jersey City* 5.

▸ *FLOW METER* — Specification S222-1 describes float actuated flow meters designed for use with Parshall flumes and Cipoletti, rectangular or v-notch weirs. Available for measuring differentials from 0-6 to 0-48 in. of water. *Minneapolis-Honeywell Regulator Co., Industrial Div., Dept. HPAC, Wayne and Windrim Aves., Philadelphia* 44.

▸ *FLUX* — New 2 page technical bulletin No. 1 gives description, uses, properties, methods of application of company's "No. 100" liquid rosin flux (nonactivated). Graph showing concentration-density relationship to "No. 400" flux thinner included. *Alpha Metals, Inc., Dept. HPAC, 56 Water St., Jersey City* 4.

▸ *FORGINGS, CASTINGS* — Data on smooth hammered forgings, composite die sections, cast-to-shape tool steels, new steel finder designed to give detailed information on various forging and casting steel grades made by company detailed in 30 page catalog. *Forging and Casting Div., Allegheny Ludlum Steel Corp.,*

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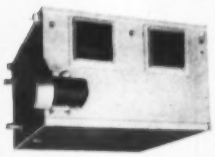
popular food chain again chooses Marlo equipment for newest outlet



AIR HANDLING UNIT

COOLING TOWER

This latest addition to the Giant chain of supermarkets in Washington, D. C. is the 19th Giant store to be air conditioned with Marlo equipment . . . undeniable evidence of Marlo's dependability and efficiency.

Marlo products specified for this installation included a ceiling type air conditioning unit, ceiling type heating and ventilating unit and two 25-ton cooling towers.

The Marlo line includes a wide variety of quality equipment to help you solve your air conditioning problems.

MARLO coil co.

SAINT LOUIS 10, MISSOURI

Quality Air Conditioning and Heat Transfer Equipment Since 1925

No "burn outs" or rear refractory repair!

FITZGIBBONS *Packaged* BOILER UNIT HAS FULL WET BACK . . .

Insulating refractory in the rear of the combustion chamber has a notoriously short life. Frequently, it cracks and collapses. But whether it lasts a year or two it is always expensive to replace — and the boiler must be shut down.

You avoid this problem for all time with the *full wet back* Fitzgibbons Packaged Boiler Unit. The rear of the Fitzgibbons combustion chamber is completely surrounded by water-backed surface. There's no refractory to overheat, to cause trouble and expense. Moreover, you can "feel" the extra efficiency of the full wet back simply by touching the rear head. It's hundreds of degrees cooler!

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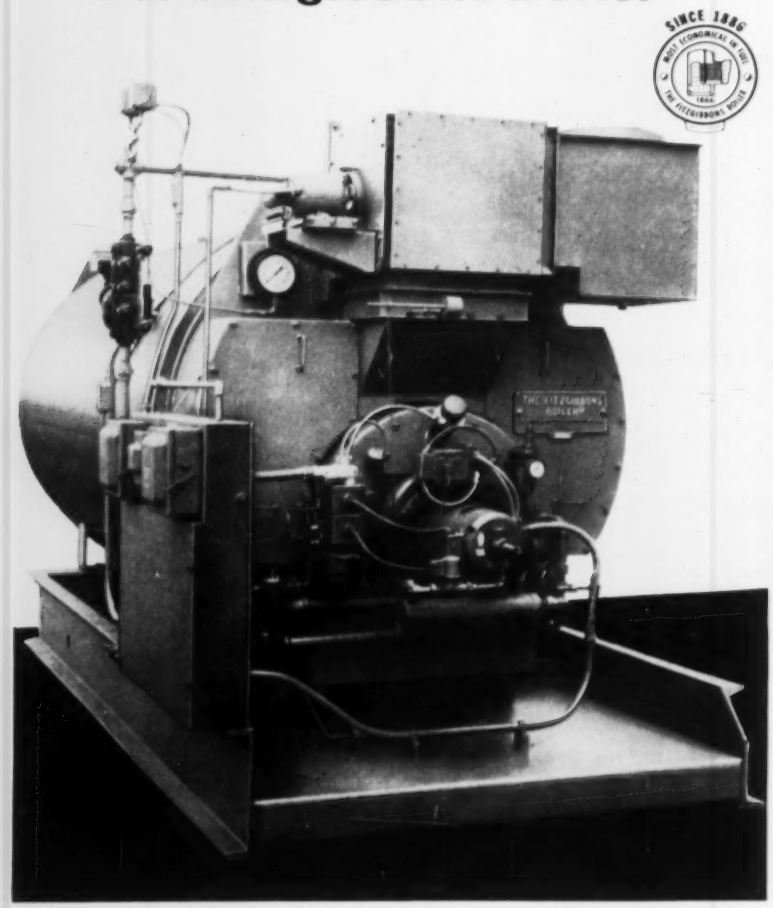
Backed by the makers of . . .

The Fitzgibbons Boiler®



RECENT TRADE LITERATURE

Continued

Dept. HPAC, 2020 Oliver Bldg., Pittsburgh 22.

▸ *GAS DETECTION* — Combustible gas detection equipment is subject of new specification sheet describing company's "Sentinel" and "Sample Drawing Sentinel." Literature gives operational and construction data, application suggestions, prices. *Johnson-Williams, Inc., Dept. HPAC, Box 6, Station A, Palo Alto, Calif.*

▸ *HEAT EXCHANGERS* — New 6 page booklet describes how "Roll-Bond" is made, lists some of its uses. Material is patterned metal designed for high efficiency heat, cold transfer. *Metals Div., Olin Mathieson Chemical Corp., Dept. HPAC, East Alton, Ill.*

▸ *HEAT TRANSFER* — Data on how to cut heat transfer costs in range of industrial applications contained in bulletin HP-356. Literature features detailed description of how "Platecoil" units are constructed. *Tranter Mfg. Co., Inc., Dept. HPAC, Lansing 4, Mich.*

▸ *HEATING EQUIPMENT* — New 4 page catalog No. 256 provides brief information on heating and cooling coils, air conditioning units, baseboard convectors, unit heaters, convectors. Includes illustrations, descriptions, specification tables. *Young Radiator Co., Dept. HPAC, Racine, Wis.*

▸ *HELICAL CONDUIT* — Bulletin C-1100-B89 tells why company's helical conduit affords savings, why it suits your specific job. Illustrates typical fittings. Lists suggested uses. *Worthington Corp., Dept. HPAC, Harrison, N.J.*

▸ *HOT WATER PERIMETER PIPING SYSTEMS* — Form 600-A9, 8 pages, illustrates advantages of three methods of hot water perimeter pip-

Mark of Integrity

...in reporting circulation facts

We display the Audit Bureau of Circulations* symbol with pride! It's our mark of circulation integrity!

The seasoned marketing man finds trustworthy data vital in his work of advertising media evaluation. And *reliable net paid circulation figures* are among the most valuable facts he uses in selecting printed media for his advertising campaigns.

Once every advertiser guessed about circulation accuracy and gambled on advertising results; today he need not question the wealth of data in any A.B.C. audit report, for it contains only *verified* answers to his most searching circulation queries.

* * *

*The Audit Bureau of Circulations, founded in 1914, is a cooperative, nonprofit association of the leading buyers and sellers of advertising space. A.B.C. sets standards for net paid circulation, audits and reports circulation facts. **To be sure of what your print media dollar buys—look for the A.B.C. symbol.***

When a media director or advertiser asks us, "How much paid circulation? What do your readers pay? Where does your circulation go? How do you get circulation—your audience for my advertising?", we need only show him our latest A.B.C. audit report. There he finds factual answers that annually pass the test of a trained A.B.C. circulation auditor's scrutiny.

And any buyer of space can decide for himself, with confidence, the value of our circulation audience. Our A.B.C. membership means circulation reported in accordance with recognized, impartial standards, established by buyers and sellers of space working together in A.B.C.

Publishers who meet the Bureau's high standards know the A.B.C. symbol as a mark of circulation integrity. The value-wise advertiser, too, has learned that *the A.B.C. symbol is his dependable guide to the audited facts* about net paid circulation that protect his advertising investments.

Heating, Piping & Air Conditioning

MEASURE OF SERVICE...MARK OF INTEGRITY

DO RIGHT BY YOUR NEXT SCHOOL JOB

—INSTALL ACTIVATED CHARCOAL

Air Purification

Odor levels in classrooms are invariably high, and traditional heating-ventilating usually fails to solve this problem satisfactorily. Full-time, complete, AIR PURIFICATION, however, is easy to install in new or existing systems by the addition of activated charcoal FilterFolds.

By recirculating return air thru FilterFolds, all odors, stuffiness, smoke or smog smells are eliminated. In addition, it's not necessary to heat new outside air continually—and that means considerable savings.

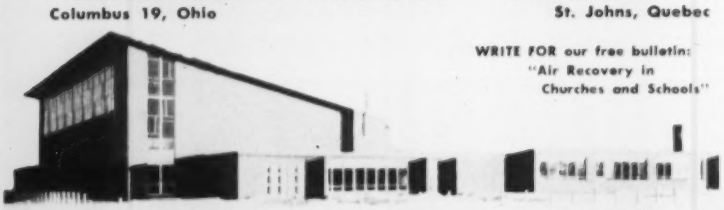
How considerable? Well, for example: By using FilterFolds, the Assumption Parish School, Richfield, Minn., saved $12,000 on original equipment. With activated charcoal to purify recirculated air, less outside ventilation is needed and a smaller boiler does the job. In addition, yearly operational savings are approximately $1,650. Projected over 30 years, the pay off is $72,000.

But there are even further benefits. Air recirculated thru activated charcoal FilterFolds is clean and healthful. Better child health and alertness result. School boards are as interested in this as in savings . . . so tell them about these double benefits of activated charcoal air purification and recovery.

BARNEBEY-CHENEY COMPANY

Columbus 19, Ohio — St. Johns, Quebec

WRITE FOR our free bulletin: "Air Recovery in Churches and Schools"



RECENT TRADE LITERATURE

Continued

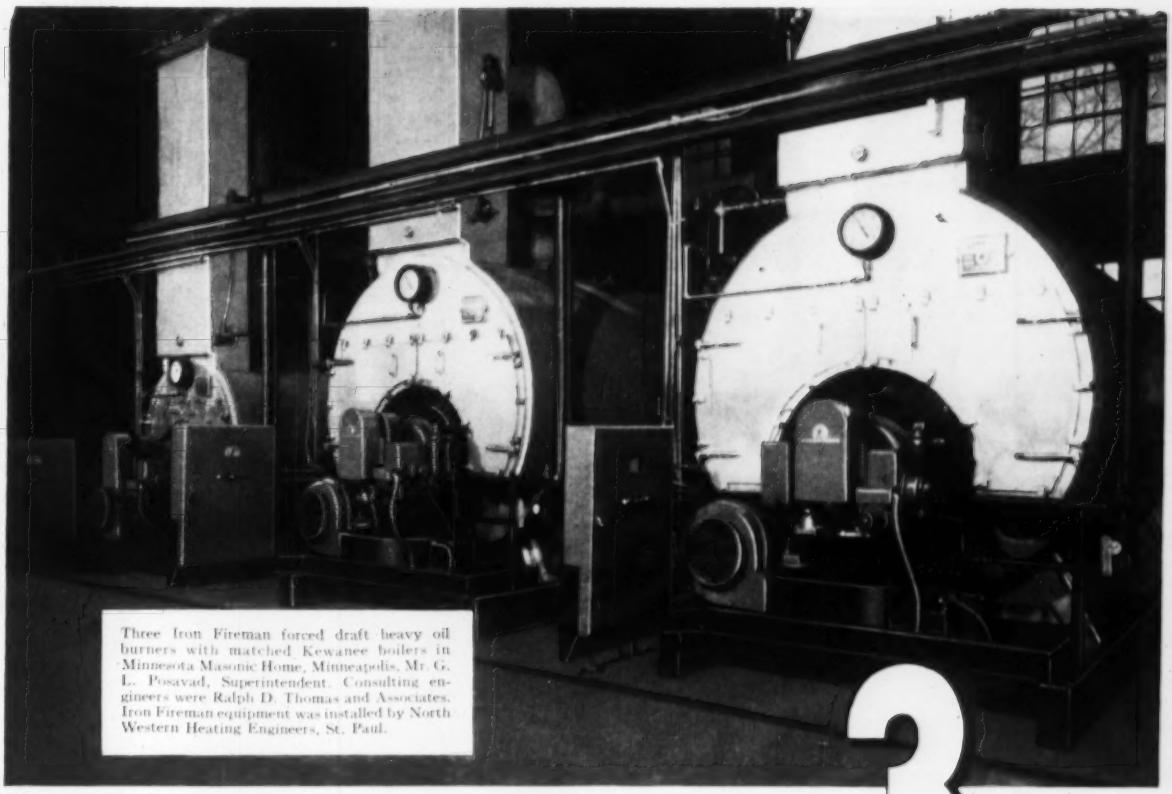
ing systems for classroom unit ventilators: wall mounted, cabinet base, recessed edge. Each method illustrated, accompanied by cited advantages. *Herman Nelson Unit Ventilator Products, American Air Filter Co., Dept. HPAC, 215 Central Ave., Louisville 8.*

▸ *HYDRAULIC FAN DRIVES* — Hydraulic fan drives for air cooled heat exchangers, cooling towers covered in bulletin 3009. Six page booklet includes detailed information on "IMO" motors and pumps and worm gear reducers that make up fan-drive unit. *De Laval Steam Turbine Co., Dept. HPAC, Trenton 2, N.J.*

▸ *INDUSTRIAL COOLING TOWERS* — New 8 page catalog covers "MTI" line of cooling towers designed especially for industrial applications where process water temperatures are critical, must be accurately maintained. Describes 44 sizes available. Gives selection data. *Baltimore Aircoil Co., Inc., Dept. HPAC, 2624 Matheus St., Baltimore.*

▸ *INDUSTRIAL ROOF EXHAUSTER* — Illustrations, performance ratings, diagrams of "Hi-velocity" industrial power roof ventilator presented in bulletin CH-101. Literature explains operational principles behind fan's "automatic" damper blades, exhaust capability, fusible link fire safety device. *Chicago Blower Corp., Dept. HPAC, 9363 Pacific Ave., Franklin Park, Ill.*

▸ *INSULATING MATERIAL* — Publication CDD-I-2 is illustrated technical report on "Irrathene" irradiated polyethylene insulating material formulated to combine overload protection with electrical, physical properties of polyethylene. Described are performance characteristics, typical applications, techniques of use. *General Electric Co., Chemical Development Dept., Dept. HPAC, Pittsfield, Mass.*



Three Iron Fireman forced draft heavy oil burners with matched Kewanee boilers in Minnesota Masonic Home, Minneapolis. Mr. G. L. Posavad, Superintendent. Consulting engineers were Ralph D. Thomas and Associates. Iron Fireman equipment was installed by North Western Heating Engineers, St. Paul.

Why it paid to split this steam plant 3 ways

Heating engineer explains why he used three Iron Fireman firing units with matched Scotch boilers in Minnesota Masonic Home

Steam costs were getting out of hand. Should the old steam plant be modernized, or replaced?

After careful analysis of all possible alternatives, a new steam plant was recommended by Mr. A. C. Hunter, president of the engineering firm of Ralph D. Thomas and Associates. This involved replacement of three high pressure HRT boilers, automatic firing equipment, surge tank, feed water heater and all other accessories.

The new plant was designed for low pressure operation, using three boiler-burner units with Iron Fireman forced draft oil burners, in which boilers and burners are engineered as a single integrated unit. Says Mr. Hunter, "Boiler sizes were based on a small unit for summer operation, a large unit for normal winter load, a large unit for standby, and operation of any two for winter peaks." The new plant provides an increase of nearly 70 per cent in rated boiler capacity to take care of future needs for heating, kitchen, water heating and infirmary.

Even with this substantially larger plant, Mr. Hunter's studies showed that the savings in fuel, maintenance and operating costs will return the entire investment in 7 years.

IRON FIREMAN FORCED DRAFT BURNERS

Each Iron Fireman firing unit is a complete combustion system, consisting of burner, forced draft air supply, fuel system and control panel. All elements are assembled, wired and tested at the factory and mounted on a single base ready to attach to the boiler front. The unit can be installed with a matched Titusville or Kewanee Scotch boiler designed specifically for this burner, or in any other type of boiler.

FOR GAS, OIL OR GAS-OIL COMBINATION

The Iron Fireman forced draft burner is available for either oil or gas, or in a dual-fuel combination unit in which fuels can be shifted instantly with no break in operation. Any grade of oil can be used, from lightest to heaviest, without special adjustment. Fires natural gas (high or low pressure), manufactured, mixed, or bottled gas. Firing unit adaptable to any type of boiler.

Send coupon for further information.

IRON FIREMAN®

Automatic Firing Equipment for Heating, Processing and Power

IRON FIREMAN MANUFACTURING CO.
5046 W. 106th Street, Cleveland, Ohio.
(In Canada, address 80 Ward St., Toronto, Ontario.)

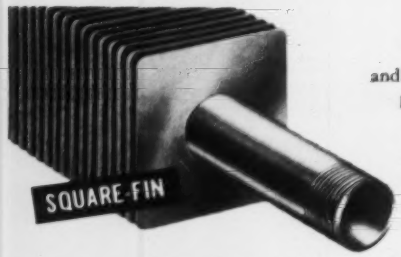
Please send technical information and specifications on Iron Fireman Forced Draft firing systems.

Name_____

Firm_____

Address_____

City_____ State_____



All *Slant-Fin* products — heating elements and enclosures — are advance-engineered and built to exacting specifications. Regardless of the application, *Slant-Fin* can meet your requirements either with a standard item from an extensive line or fabricate an assembly for your special needs.

WHEN YOU NEED FINNED-TUBE FOR HEATING...REMEMBER THESE

5 reasons

WHY YOU SHOULD ALWAYS SPECIFY

SLANT-FIN

1. Highest heat output

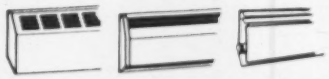
You have a choice of heating elements — the traditional Square-Fin Series or the distinctive Slant-Fin Series with many exclusive advantages. With greater surface per fin and interlocking fin-and-flange construction, these elements supply a high heat output per linear foot. A variety of fin spacings and tube sizes from ¼" to 2" provide a complete range of approved ratings.

2. The most complete line for commercial heating

For office buildings, factories, churches, schools, hospitals and other large area heating installations, *Slant-Fin* radiators and enclosures are unsurpassed. Heating elements in 1¼" and 2" all-steel, all-copper or copper-aluminum provide maximum heating efficiency with economical material and labor costs. A wide range of enclosures from the practical expanded metal to the ultra-modern "low line" permits complete flexibility for individual requirements.

3. Residential baseboard, too

For private offices, hotel rooms, motels, or any small space where both heating efficiency and appearance are desired, *Slant-Fin's* complete line of residential baseboard is ideal. Again, you have a wide choice. Four different heating elements of ¾", 1" and 1¼" are available in all-steel or copper-aluminum. Three different enclosure styles, too.



4. Labor and material savings

Slant-Fin products are made to be installed in the shortest possible time. For example, snap-on enclosures eliminate the need for screws, tools or special mountings. And both heating elements and enclosures are supplied in pre-cut lengths, tailored to your job.

5. Special applications

For special industrial and commercial process applications, either heating or cooling, *Slant-Fin* has the engineering experience and exclusive production techniques to fabricate finned-tube to the user's particular needs. Whether made of stainless or galvanized steel, wrought iron or aluminum, the finished assemblies will meet the most rigid tests for quality construction and efficiency.

You owe it to your reputation to include Slant-Fin in your plans. Catalog 1000 describes Slant-Fin's commercial and residential line. Write today for your copy.

SLANT-FIN RADIATOR CORPORATION

87-49H 130th Street • Richmond Hill 18, New York

RECENT TRADE LITERATURE

Continued

▸ *INSULATION* — "Microlite" insulation, its performance and uses, described in 4 page brochure WML-5. In addition to thermal, acoustical performance charts, gives brief description of how product is made. *L.O.F Glass Fibers Co., Dept. HPAC,* 1810 *Madison Ave., Toledo* 1.

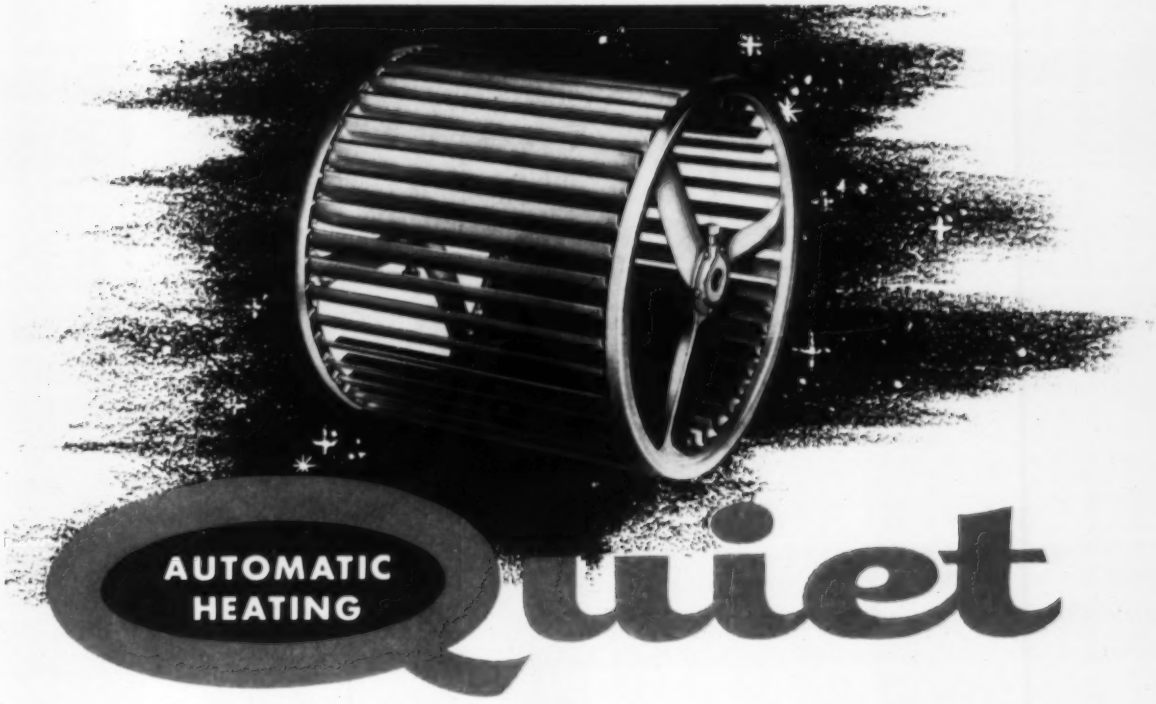
▸ *MOTOR DRIVES* — Motor drives designed with positive pulley adjustment, ranging ½ to 25 hp, subject of new 8 page bulletin 1610-B1 P. Literature contains selection information. Describes engineering features, remote controls, separate motor drive. *Worthington Corp., Dept. HPAC, Harrison, N.J.*

▸ *MOTORS* — Bulletin GED-2020B, 16 pages, gives information on how to choose correct fractional horsepower motor. Contains motor application, selection data for 50 typical installations. Various motor types illustrated. *General Electric Co., Dept. HPAC, Schenectady* 5, *N.Y.*

▸ *O-RING TUBE FITTINGS* — Features, descriptions, illustrations of o-ring tube fittings designed to eliminate flaring, threading, welding, soldering presented in 4 page folder. Specification tables included. *Lenz Co., Dept. HPAC,* 3301 *Klepinger Rd., Dayton* 1.

▸ *PANEL CONTROL SYSTEMS* — Complete line of "Fireye Series AC" panel control systems for oil, gas, combination burners described, illustrated in 16 page bulletin CA-22. Includes application, operation, component data. *Electronics Corp. of American, Combustion Control Div., Dept. HPAC,* 77 *Broadway, Cambridge* 42, *Mass.*

▸ *PIPE FITTINGS* — Bulletin gives net prices for company's line of unions, couplings, reducers, half couplings, caps, hex plugs and bushings, flush bushings, round plugs, bull plugs, welding spuds, swage nipples,



AUTOMATIC HEATING

Quiet

made possible with the

MORRISON

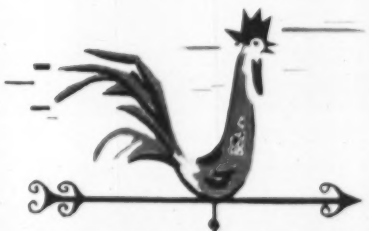
precision-built blower!

For the even distribution of Air — conditioned to just the right temperature for comfort at its best — Morrison is contributing to much of the finest heating and air-conditioning equipment on the market today.

Of almost equal importance to the even flow of air, is the element of quiet operation.

This is a prime demand of DELTA as "DELTA HEATS AMERICA AUTOMATICALLY!" It has been a happy experience working with this firm to help build for "comfort at its best".

Write our engineers about your Blower problems. *Ask for Blower catalog.*



MORRISON blower used in above unit

MORRISON PRODUCTS INC.

16816 WATERLOO RD.
CLEVELAND 10, OHIO

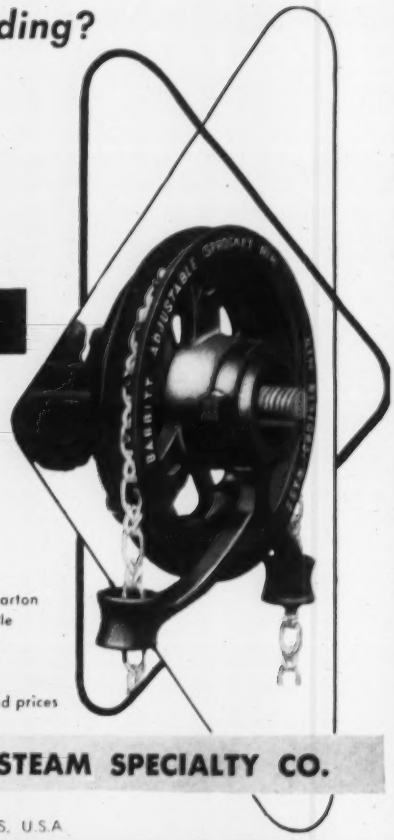
Building or Expanding?

THINK of
SAFETY
CONVENIENCE
ECONOMY
THINK of

Babbitt

Adjustable
SPROCKET RIM
with Chain Guide

- Simplifies pipe layout
- Fits any size valve wheel
- Easy to install and operate
- Operates any valve from plant floor
- Time and money saving fixture
- No maintenance, first cost only cost
- Packed, completely assembled, one to a carton
- Hot galvanized, rust proof chain available for all sizes
- Easy to follow instructions with each unit
- Your supplier carries complete stocks
- Write for new descriptive catalog sheet and prices



Babbitt **STEAM SPECIALTY CO.**

6 BABBITT SQUARE, NEW BEDFORD, MASS. U.S.A.

"Long after price is forgotten
Quality is still remembered"

Golden-Anderson has never sacrificed quality just to "close the order." For over 50 years we have been designing and manufacturing valves that give dependable operation . . . that need little maintenance . . . that last a lifetime.

Let our experience and know-how work for you, too.

Technical bulletins, describing each of our valves in detail, gladly sent on request.

GOLDEN ANDERSON *Valve Specialty Company*
1210 RIDGE AVE., PITTSBURGH 33, PA.

Designers and Manufacturers of **VALVES FOR AUTOMATION**

RECENT TRADE LITERATURE

Continued

lock nuts, elbows, tees, crosses, flanges, flange fittings. *Alloy Stainless Products Co., Dept. HPAC, Union Blvd., Totowa, N.J.*

▶ *PIPE HANGERS* — New 16 page bulletin 156 describes "Counterpoise" pipe hangers. Booklet gives specifications to complete line, engineering drawings of all models, weight-load selection tables, erection and adjustment information. *National Valve and Mfg. Co., Dept. HPAC, 3100 Liberty Ave., Pittsburgh 1.*

▶ *PIPE INSULATION* — New 40 page catalog on "Unibestos" pipe insulation presents new way to specify proper thickness. Book also features detailed drawings that show how single-layer insulation is applied to various vertical and horizontal expansion joints, pipe bends, flanges, valves, fittings. *Union Asbestos & Rubber Co., Dept. HPAC, 1111 W. Perry St., Bloomington, Ill.*

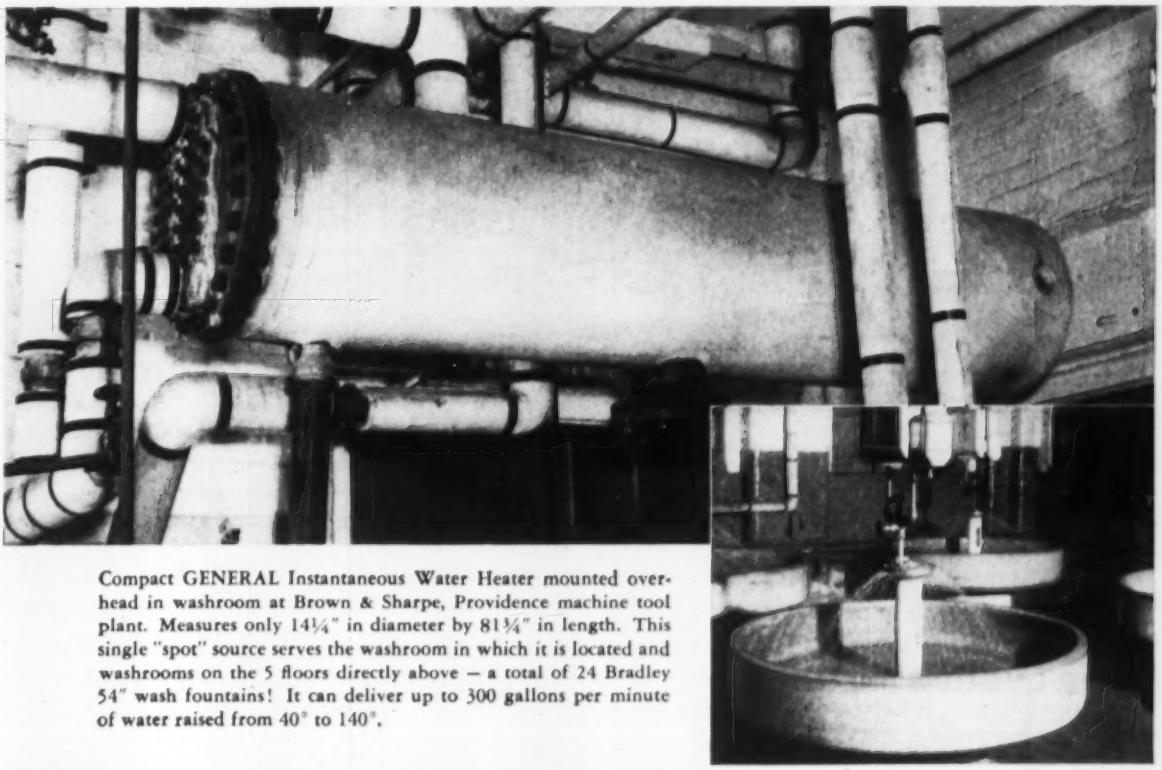
▶ *PIPE, TUBING, FITTINGS* — Technical data card 145-A contains condensed data on mechanical properties, creep strength, physical properties, hot and cold bending, welding, heat treatment, working pressure for "Croloy" steel pipe, tubing and welding fittings. *Babcock & Wilcox Co., Tubular Products Div., Dept. HPAC, Beaver Falls, Pa.*

▶ *PLASTIC PIPE* — Bulletin No. CE-57 covers flexible polyethylene plastic pipe. Contains details about general, technical uses of product. Flow charts, installation instructions included. *Supplex Co., Div. of American Hard Rubber Co., Dept. HPAC, Garwood, N.J.*

▶ *PNEUMATIC CONTROLLERS* — "Series 500" pneumatic controllers described in new 56 page bulletin AE30. Sections describe control principles, illustrate various control modes available. *Bristol Co., Dept. HPAC, Waterbury 20, Conn.*

ECONOMICAL HOT WATER SOURCES FOR MODERN INDUSTRY

How *Brown & Sharpe* keeps hot water capacity in step with modernizing



Compact GENERAL Instantaneous Water Heater mounted overhead in washroom at Brown & Sharpe, Providence machine tool plant. Measures only 14¼" in diameter by 81¾" in length. This single "spot" source serves the washroom in which it is located and washrooms on the 5 floors directly above — a total of 24 Bradley 54" wash fountains! It can deliver up to 300 gallons per minute of water raised from 40° to 140°.

Extra economy was combined with extra efficiency in providing hot water for the modernized washrooms, foundry showers, and kitchen at Brown & Sharpe, Providence, R. I. Single, compact GENERAL Instantaneous Water Heaters were "spotted" at strategic points throughout the 36 acre plant to serve groups of up to six individual facilities. Installation was quick and easy in existing steam lines . . . no bulky storage tank or complicated piping. Piping runs were held to a minimum — heat waste avoided. And there's always plenty of continuous hot water for everyone — even when the boys down at the foundry hit the showers!

More and more modern plants are using GENERAL Instantaneous Water Heaters for spot installations, booster installations, and complete new installations. They're space-savers, money-savers, fuel-savers. Available in a wide range of capacities up to 300 gallons per minute . . . heated with live or exhaust steam, at 5 to 125 psi, or boiler water. Write for Catalog 61. General Fittings Company, Box 151E, East Greenwich, R. I.

GENERAL FITTINGS COMPANY

TANKLESS AND INDIRECT WATER HEATERS AND HEATING SPECIALTIES

FUEL-AIR CONTROLLERS
ELECTRIC POWER UNITS
AIR SAFETY SWITCHES
INDICATING INSTRUMENTS
DRAFT REGULATORS
CONTROL PANELS
AUTOMATION IN COMBUSTION
CLEVELAND SEQUENCE DRAFT
Control Systems
• For all methods of firing
• For natural or induced draft
• Fully modulating
• All electric operation
FEATURING
• Lo-Draft Safety Switch
• Time Delay for Nuisance Puffs
• Starting Draft Selector
1 2 3
Typical schematic of "Cleveland" Draft Control System taken from FREE booklet.
Free
Ask for booklet, "Control Fundamentals and Their Application to Combustion"
CLEVELAND CONTROLS
BROOKPARK ROAD • CLEVELAND 9, OHIO
Controls by "Cleveland" Every Location in the Nation
Over 100 Sales Engineers Ready to Serve You

ever try to sit on a
2 LEGGED MILKING STOOL

A "2 legged" forced air ventilating system is just as unbalanced—it takes THE TRIPLETS—WARM-AIR COOL-AIR and ELECTRO-AIR to have perfect air control.

Electro-air Electronic Air Cleaners are available in models of suitable dimensions and air handling capacity for every size building—from the smallest home to the largest office building.

"Built-up Line" units—1,350 to 200,000 cfm
"Custom Line" units—1,350 to 12,000 cfm
"Compact Line" units—800 to 4,800 cfm

All parts including selenium rectifiers are guaranteed for five years.

WRITE FOR CATALOG CB-20-B

ELECTRO AIR **ELECTRO-AIR CLEANER COMPANY**
1285 REEDSDALE STREET, PITTSBURGH 33, PA.

RECENT TRADE LITERATURE

Continued

▸ *PRESSURE SWITCH* — Brochure shows actual size, construction of typical "Barksdale-Meletron" bourdon tube pressure switch for intermediate and high pressure control systems. *Barksdale Valves, Dept. HPAC, 5125 Alcoa Ave., Los Angeles 58.*

▸ *RADIATION SELECTOR KIT* — Kit designed to enable contractors to accurately figure right amount of baseboard and proper convector capacity for any job includes pad of work sheets for recording design conditions and dimensional data for individual rooms, dial chart with heat loss calculator on one side and baseboard selector on other, convector selector card. $1.00 each. *Trane Co., Dept. HPAC, La Crosse, Wis.*

▸ *RESISTANCE WELDING* — Literature describes, illustrates heavy resistance welding which originated from company's Paris, France, plant. Deals with fabricating of heavy steel structural members, how resistance welding has been used. *Sciaky Bros., Inc., Dept. HPAC, 4915 W. 67th St., Chicago.*

▸ *SCREWED FITTINGS CALCULATOR* — Slide rule-like calculator offered to aid in ordering large quantities of company's packaged fittings by the carton. Covers malleable fittings from bushings to 90 deg street elbows. *Crane Co., Dept. HPAC, 836 S. Michigan Ave., Chicago 5.*

▸ *SPEED REDUCERS* — Bulletin No. 98 details "Bantam" speed reducers. Units designed to have maximum power output of 0.1 hp at low speed shaft. Standard units, units with anti-backlash feature described. *Metron Instrument Co., Dept. HPAC, 432 Lincoln St., Denver 3.*

▸ *TEMPERATURE CONTROL* — Bulletin MC-133 describes "Series

Even your tricky pipe racking is easier with UNISTRUT® channel

Typical service tunnel in large Midwest university

You make more money with UNISTRUT channel, too—by saving time, men and materials on this foolproof, superior method of pipe racking.

You start with everything you need—channel, clamps, hangers, concrete inserts, rollers or any other accessories. Everything is provided by UNISTRUT from standard stock.

Next, you forget about drilling, welding or riveting. With UNISTRUT, you simply cut the channel to length...slip the UNISTRUT nut in the channel slot...and tighten with a wrench. That's it!

Correct slope or pitch? No problem at all with UNISTRUT—it's completely adjustable. Future alterations or additions? With the flexible UNISTRUT System, you can make them any time.

Study these advantages a few moments—and you'll see why thousands are switching to the modern, high-speed UNISTRUT System for superior support of steam, gas, light conduit, air conditioning or heavy water lines. Get the facts now! Write for 78-page illustrated Catalog 700 giving complete information. Consult your telephone directory today for the name of your nearest UNISTRUT Distributor.

UNISTRUT PRODUCTS COMPANY
933 W. Washington Blvd., Dept. H-11
Chicago 7, Illinois

U.S. Patent Numbers: 2327587 2329815 2380379 2383382 2345850 2541908 2405831 2686139 Other Patents Pending

The World's Most Flexible All-Purpose Metal Framing

UNISTRUT®

CLIP AND MAIL TODAY

UNISTRUT PRODUCTS COMPANY
Dept. H-11, 933 W. Washington Blvd.
Chicago 7, Ill.

☐ Please send your Catalog 700.
☐ Please have your salesman call, no obligation.

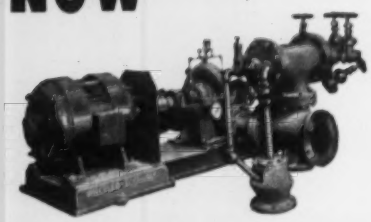
Name.....

Company.....

Address.....

City.....*Zone*....*State*.....

PROVIDE FOR FIRE PROTECTION NOW



with a

WHEELER-ECONOMY FIRE PUMP

A delay in the planning or completion of your fire protection program may mean loss of life, property or operation. For a complete and effective plan include one or more Underwriters Laboratory and Factory Mutual Fire Insurance Companies approved Wheeler-Economy Fire Pumps.

Write for catalog **L-1**

WE-810

C. H. WHEELER
Manufacturing Co.
ECONOMY PUMP DIVISION
19th and Lehigh,
Philadelphia 32, Pa.

RECENT TRADE LITERATURE

Continued

53000" thermistor-actuated temperature controller. Controller designed as individual unit which is plugged into separate power supply chassis. *Fenwal, Inc., Dept. HPAC, Ashland, Mass.*

▸ *TEMPERATURE CONTROLS* — Six page catalog MC-135 covers complete line of "Thermoswitch" temperature controls. Literature gives physical specifications, performance data, temperature ranges, other pertinent information. Also listed are various modifications, special features. *Fenwal, Inc., Dept. HPAC, Ashland, Mass.*

▸ *TESTING SERVICES* — New 72 page catalog outlines services, facilities of test laboratory. Covers chemical, electrical, electronic, mechanical and physical, photometric, radiometric, calorimetric testing. *Electrical Testing Laboratories, Inc., Dept. HPAC, 2 East End Ave., New York 21.*

▸ *THERMOCOUPLE EXTENSION WIRE* — Specification S002-1 describes new moisture resistant, flexible polyvinyl plastic insulated thermocouple extension wire, available in 14, 16, 20 gage sizes for use with all types of thermocouples supplied by company. *Minneapolis-Honeywell Regulator Co., Industrial Div., Dept. HPAC, Wayne and Windrim Aves., Philadelphia 44.*

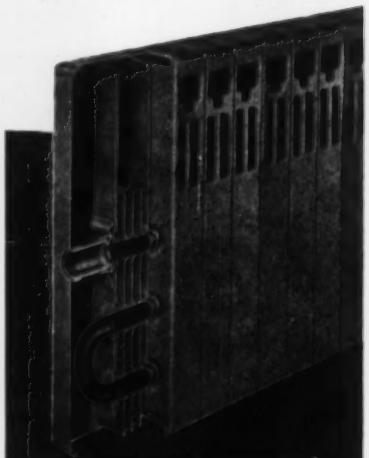
▸ *THERMOCOUPLES* — Ten page bulletin No. 2 details miniature bayonet thermocouples. Applications include temperature measurement of engine and pump cylinder heads, turbine housings, pipes, electric motors, generators. *Thermo Electric Co., Inc., Dept. HPAC, Saddle Brook, N. J.*

▸ *THERMOSTATIC CONTROL VALVES* — Engineering data on "Type S" temperature regulators for

2 kinds of heat

RADIANT and CONVECTED

from SHAW RADIATORS



always *properly* distributed in the room!

Shaw Radiators "heat-condition" a room for *natural* comfort by delivering *radiant* heat that warms solid objects, and *convected* heat to warm the atmosphere.

This AIR-e-ATED Radiant Heat, exclusively Shaw's, is distributed in unvarying, health-guarding proportions that only Nature—*at her best*—can rival.

AIR-e-ATED Radiant Heat is the result of Shaw's fully self-contained construction, featuring full length steel heating fins and exterior radiant panels *all tightly bonded to the copper heating coils.* Shaw units—panel or baseboard—are but 3" thick, easily handled and installed. Choice of same end or opposite end tapping permits simplified piping, lower piping costs. Hot water or steam may be used up to 150 psi.

Write today for free literature SP-17

SHAW-PERKINS MFG. CO.
201 EAST CARSON ST., PITTSBURGH 19, PA

READ ABOUT THE SWING TO *SIL-FOS* BRAZED NON-FERROUS TUBING

This bulletin tells you about important new buildings in which top-ranking contractors installed SIL-FOS brazed non-ferrous tubing systems — and WHY.

If you have anything to do with building design and construction, you will be interested in the information in this bulletin. WRITE for a copy today. Ask for "Brazing News No. 71."

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LOOK AT THIS NEW FORCED-DRAFT BURNER THAT DELIVERS BIG PERFORMANCE

OIL syncro flame OIL

FOR COMMERCIAL AND INDUSTRIAL INSTALLATIONS

While this burner *looks* like a standard residential type, it is a *big* heavy-duty machine. Features include two-stage fire, built-in controls for pre-purge, post-purge, and high-low-off fire control with automatic air/fuel ratio settings, terminal strips for accessory wiring, and wide ranges of capacities.

FOR 20 TO 150 H.P. BOILERS HIGH STACK NOT REQUIRED

SYNCRO/FLAME Pressure Burners are capable of firing efficiently into combustion chamber pressures of 3" of water or more, eliminating the need for high stacks or expensive forced draft equipment. *No ordinary burner can do this!* SYNCRO/FLAME Pressure Burners are available for oil, gas, or dual-fuel service.

DETAILS ON REQUEST

Write today for data sheets describing all features and giving full specifications.

MANUFACTURERS OF OIL AND GAS AND OIL/GAS BURNERS
SYNCHRONOUS FLAME, INC.
WALWORTH • WISCONSIN

RECENT TRADE LITERATURE

Continued

instantaneous heaters, hot water generators contained in bulletin M-3. *Lawler Automatic Controls, Inc., Dept. HPAC, Mt. Vernon, N. Y.*

▶ *THREAD GAGE* — Pocket sized thread gage offered free from manufacturer of fittings. Identifies threads 8 to 14 per in., round or sharp, external or internal. *Pittsburgh Pipe & Coupling Co., Dept. HPAC, Allison Park, Pa.*

▶ *TIME CONTROLS* — New 20 page booklet is reference to company's multipurpose and industrial time controls. Can be used as up-to-the-minute check list of time switches, timers. Reference chart defines what each control is, what it does, where it may be used, how to select and purchase it. *Paragon Electric Co., Dept. HPAC, Two Rivers, Wis.*

▶ *TUBING* — Brochure illustrates, describes company services. Contains tables on hardness conversion, equivalents of B.W. gages and fractions of an inch, round tubing, tolerances, standard sizes, square tubing. *Nikoh Tube Co., Dept. HPAC, 5000 S. Whipple, Chicago 32.*

▶ *TUBING SYSTEM DATA* — New 8 page booklet contains information including charts, tables to aid in proper selection of tubing as to size, wall thickness, material for various operating conditions. Factors considered are flow requirements, pressures, severity of service and temperatures. *Tube & Hose Fittings Div., Parker Appliance Co., Dept. HPAC, 17325 Euclid Ave., Cleveland 12.*

▶ *VALVE PARTS* — Catalog FPL-11 contains 32 pages of cross-section and parts, together with list prices, covering fluorinated hydrocarbon refrigerant valves and accessories, in-

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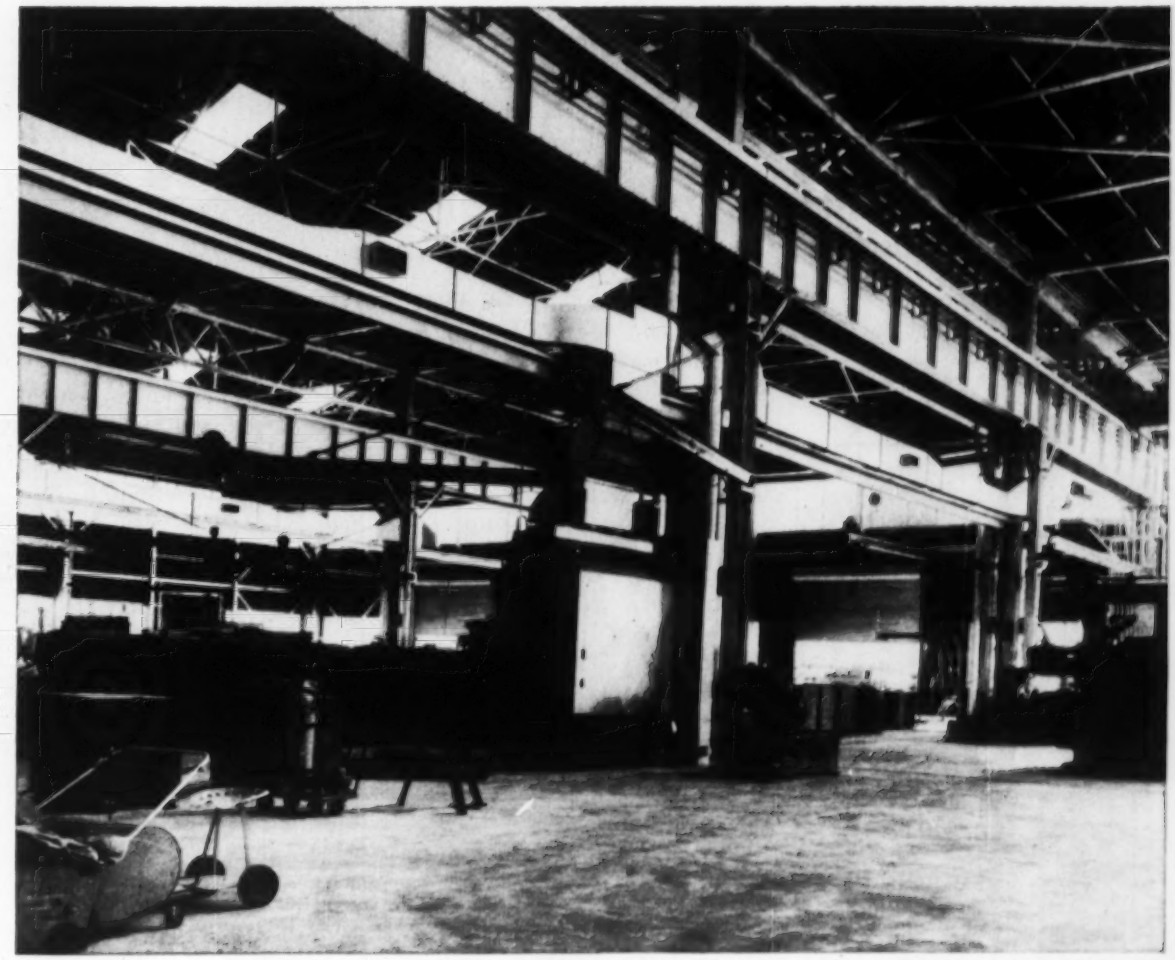

Dravo heater supplies warm air as needed in this southern plant.

Dravo heaters provide economical solution to "chilly morning" problem in Texas

Early morning temperatures go below freezing during part of the year in Texas, but as the sun gets higher the thermometer quickly climbs to 75° and higher.

To maintain a constant heat level under these rapidly changing conditions, Oil Well Supply Division of United States Steel Corporation chose Dravo *Counterflo* heaters for their Garland, Texas plant and warehouse. Six 2,000,000 Btu per hour Dravo heaters provide instantaneous transfer of heat from combustion chamber to air stream. This eliminates lag in comfort heating during the chilly morning hours. A thermostat mounted in the return air stream cuts off the fan motor and fuel supply at a predetermined temperature, thus preventing heat-override.

Dravo *Counterflo* heaters are efficient and economical. They require minimum capital investment, minimum installation expenditure, provide low operating costs and there is no need for a full time operator.

Custom engineered Dravo heaters are designed to solve your particular heating problem and save you money at the same time. Why not write for complete information? Address—Dravo Corporation, Machinery Division, Dravo Building, Pittsburgh 22, Pa. Sales representatives in principal cities.

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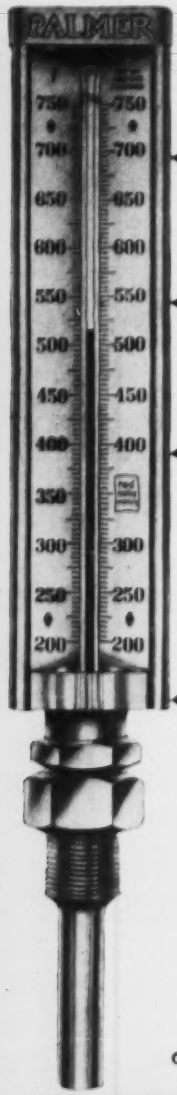

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Extruded Brass Case

Chrome Finish

Ranges −40 to 950°F or Equivalent in °C

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RECENT TRADE LITERATURE

Continued

cluding packless and packed valves, check valves, strainers, driers, liquid level gages for air conditioning, refrigeration, industrial applications. *Henry Valve Co., Dept. HPAC, 3215 North Ave., Melrose Park, Ill.*

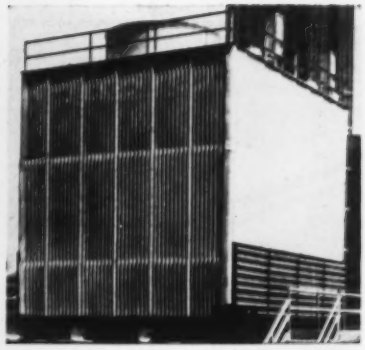
▸ *VALVE SELECTION* — Aid in helping valve users select proper valve for required service presented in two valve check charts. One is for bronze valves, other for iron body types. Each describes basic gate, globe, angle and check valve types, gives information on their design, operation, service characteristics, proper use. *Kennedy Valve Mfg. Co., Dept. HPAC, Elmira, N. Y.*

▸ *VALVES* — Two pressure classes of company's "LQ600" bronze globe valves detailed in 4 page circular No. 602-2. Range is for wide variety of services from normal to exceptionally severe. *Lunkenheimer Co., Dept. HPAC, Box 360, Cincinnati 14.*

▸ *VANE ACTUATED SWITCH* — Specification S800-1 describes, illustrates "Brown Electr-O-Vane" control unit, an electric switch actuated by torque of 2 gram-in. or less. *Minneapolis-Honeywell Regulator Co., Industrial Div., Dept. HPAC, Wayne and Windrim Aves., Philadelphia 44.*

▸ *VARIABLE SPEED MOTOR PULLEYS* — Bulletin 1630-B1 P features motor pulleys (⅛ to ¾ hp) available with adjustable and tilting motor bases, companion sheaves, motor bases, v-belts. Charts list ratings, dimensions, selection data. *Worthington Corp., Dept. HPAC, Harrison, N. J.*

▸ *VENTILATION* — New 64 page brochure contains descriptions, photographs, engineering drawings, specification tables and graphs for company's ventilator line including

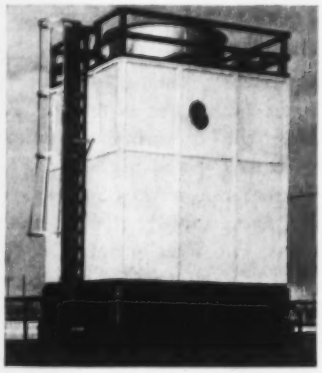


The Phillips Transite Cooling Towers have been in operation over nine years and proven to furnish the required cooling with lowest possible maintenance cost. Phillips Towers are available with framing of California Redwood or Hot Dipped Galvanized Steel as preferred.

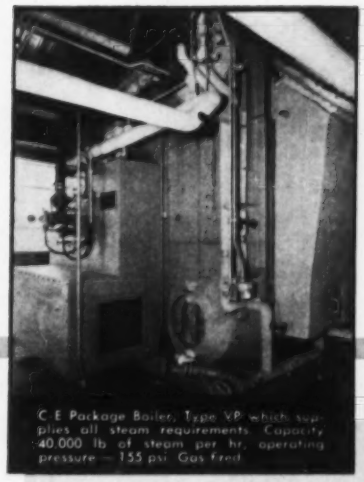
The new Phillips nailless fill adds to simplicity of erection and maintenance.

The Phillips eliminator system guarantees minimum drift loss.

When you have a cooling problem call your Phillips representative.



Phillips Cooling Tower Co., Inc.
220 DUPONT ST., BROOKLYN 22, N. Y.



C-E Package Boiler, Type VP, which supplies all steam requirements. Capacity 40,000 lb of steam per hr, operating pressure — 155 psi. Gas fired.

"RELIABLE—ECONOMICAL —LOW ON MAINTENANCE"

Says Mr. Max R. Spencer—Superintendent Central Soya Co., Inc.—McMillen Feed Mills

From an original water color of the Central Soya Co., Inc. — McMillen Feed Mills by Kent Day Coes. Commissioned by "Factory" magazine for their 1956 Significant Plant Awards.

"Our package boiler, after 18 months of operation, has proven to be very reliable, economical and low on maintenance costs. Ease of start-up, shut-down and continuous operation permitted quick training for our operators."

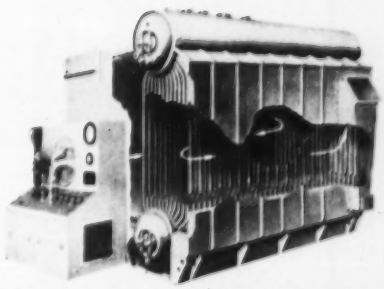
Mr. Max R. Spencer, Maintenance Superintendent of the Central Soya Co., Inc.—McMillen Feed Mills—of Chattanooga, Tenn., was referring to his C-E Package Boiler, Type VP, when he made that statement.

It's a boiler that has to be good—has to be reliable—for it is presently the sole source of steam supply for this outstanding plant. And it *is* an outstanding plant having been named one of "The 1956 Winners of Factory's Significant Plant Awards."

Central Soya is a real, modern "triple threat" operation. It comprises: (1) mammoth new grain-handling elevators, (2) feed mill, and (3) soybean solvent extraction plant all integrated into a smoothly operating "continuous process" plant that is expandable and ready for any foreseeable need.

Combustion Engineering is proud that its VP Package Boiler has been assigned a key role in the operating plan of this notable mill. Gratified, too, that it is proving to be all that Mr. Spencer had hoped for.

A C-E Package Boiler, Type VP can do the same kind of a job for you. Let us give you more information.



Cutaway view of typical VP Boiler. For capacities from 4,000 to 40,000 lb of steam per hr. Pressures to 500 psi. Oil or gas fuel.

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C-E

B-9428

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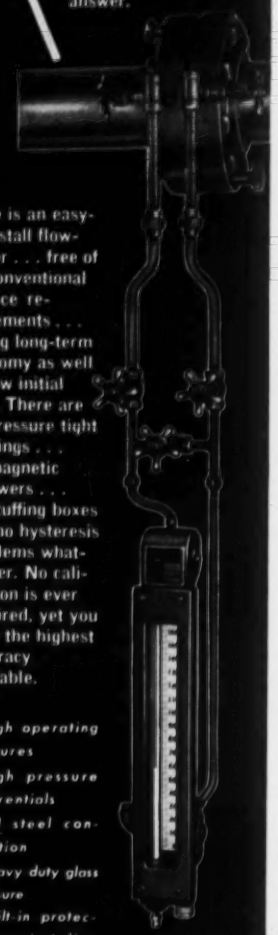
UNMATCHED ACCURACY

in direct flow indication

Wherever you seek simplicity and high accuracy in flow measurement at lowest cost, the Meriam "H" Meter is the well-known answer.



Here is an easy-to-install flowmeter . . . free of all conventional service requirements . . . giving long-term economy as well as low initial cost. There are no pressure tight bearings . . . no magnetic followers . . . no stuffing boxes . . . no hysteresis problems whatsoever. No calibration is ever required, yet you have the highest accuracy available.

★ High operating pressures
★ High pressure differentials
★ All steel construction
★ Heavy duty glass enclosure
★ Built-in protection against line surges

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Meriam Manometer Instrumentation
...for pressures, vacuums, flows, liquid levels.

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RECENT TRADE LITERATURE

Continued

units for hot industries, clear-opening models, inflow units, inlet type, dark room unit, two-way fan model. *Colt Ventilation of America, Inc., Dept. HPAC, 4652 Hollywood Blvd., Los Angeles 27.*

▸ *VERTICAL FILING SYSTEMS* — New 8 page catalog No. 5 shows four different methods of vertically filing blueprints using "Plan Hold" line of vertical filing equipment. *Plan Hold, Div. of Air Comfort Co., Dept. HPAC, 5204 Chakemco St., South Gate, Calif.*

▸ *VIBRATION, NOISE CONTROL* — Bulletin K7A shows by means of case histories how profits, production can be increased through use of vibration and noise control machinery mountings. Insert section explains theory, purpose of machine tool vibration control, discusses problem of leveling vs. alignment. *Korfund Co., Inc., Dept. HPAC, 43-01F 32nd Pl., Long Island City 1, N. Y.*

▸ *VITRIFIED CLAY CONDUIT SYSTEMS* — Four page brochure describes line of vitrified clay conduit systems. Information on conduit design, installation, engineering, insulation, waterproofing specifications, fittings included. *Stillwater Clay Products Co., Dept. HPAC, 3334 Prospect Ave., Cleveland 15.*

▸ *WATER COIL SELECTION* — Four page publication FM-J.561L contains selection data for water coils. For use in conjunction with 12 page coil catalog D-5.521 and "HHF" and "HHV" line of air conditioning equipment cataloged in F.M.-G.5622. *Drayer-Hanson, Inc., Dept. HPAC, 3301 Medford St., Los Angeles 63.*

▸ *WATER COILS* — Catalog No. 53c0a incorporates several charts de-

CAP CAPITOL
300# FORGED STEEL
UNIONS

LISTED UNDER RE-EXAMINATION SERVICE UNDERWRITERS' LABORATORIES, INC. UL

This U.L. Label Guarantees Quality

- Brass or integral steel seat
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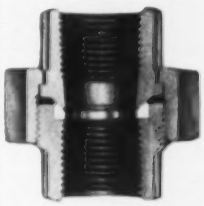

Available from stock in sizes ½" through 2", 300# steam or 2000# cold water, oil or gas, non-shock.

PLUS Capitol's package

extra protection and easier handling at no extra cost means

EXTRA PROFIT

order all your fitting requirements from

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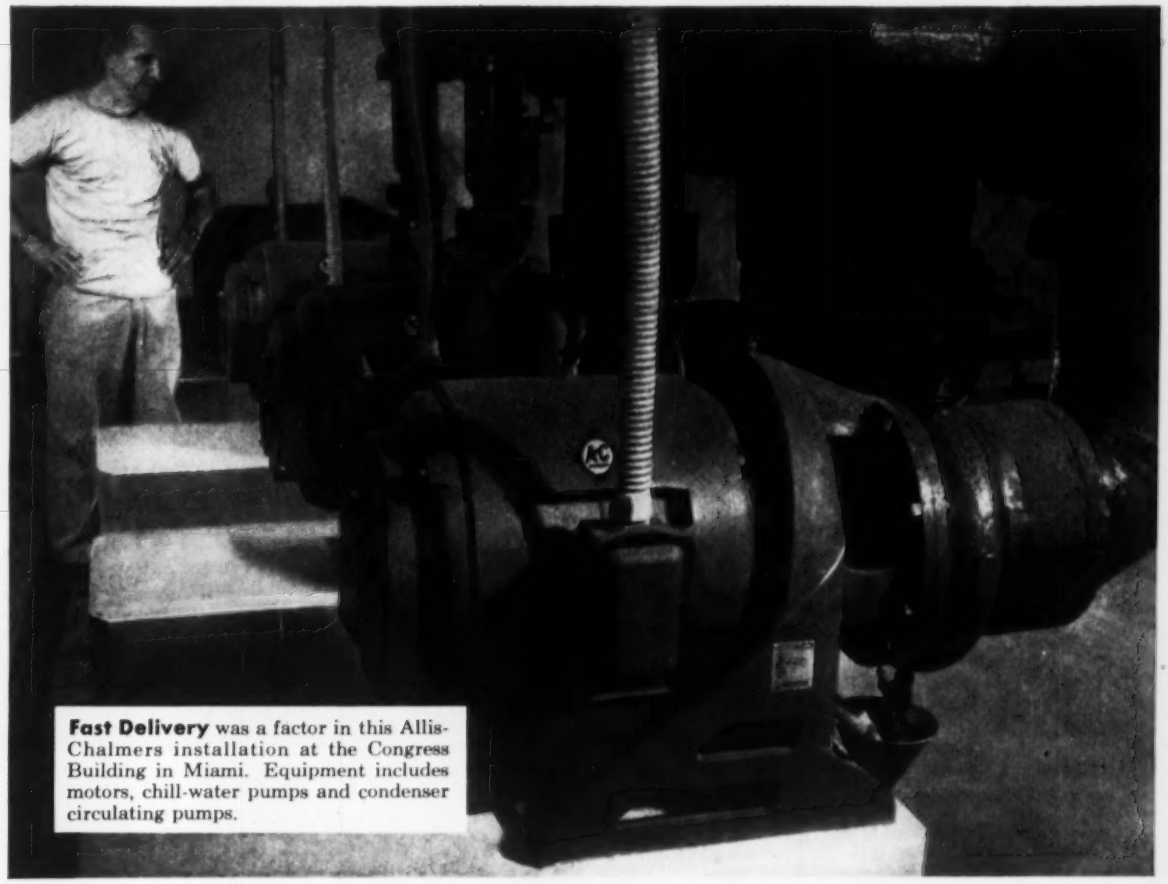


Fast Delivery was a factor in this Allis-Chalmers installation at the Congress Building in Miami. Equipment includes motors, chill-water pumps and condenser circulating pumps.

For quick delivery on motors and pumps

Specify Allis-Chalmers

WHEN you specify equipment for air conditioning installations, you want *dependability* and delivery *when you need it*. Allis-Chalmers guarantees you both with its complete line of motors and pumps.

Local Stock

A national network of authorized distributors, plus strategically located warehouse stocks, assures you *prompt* delivery of the right equipment for your job. Whatever your location, Allis-Chalmers makes sure that your installation won't be slowed down by poor delivery or "broken shipping promises".

More Dependable Cooling

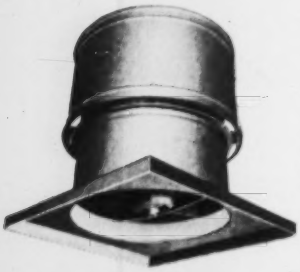
Once you install Allis-Chalmers, your system has equipment known for its ability to keep going season after season. Unit responsibility means A-C pumps and motors are engineered to work together. Your customers are assured of staying cool and you slash service call-backs.

Along with Motors and Pumps, A-C supplies control and V-belt drives. You can obtain the name of your distributor by contacting your nearby Allis-Chalmers sales office, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

A-5188

FOR
Fast
DISCHARGE of AIR at HIGH VELOCITY



allen
VERTICAL DISCHARGE FAN

• Keeps fumes from leaking back through building openings

Whenever you face the problem of discharging fumes through a roof so that they will not short-circuit back through building openings, you'll find the solution in this Vertical Discharge Fan. It is designed especially for industrial applications that require the removal of a large volume at high velocity. It is fabricated of zinc-coated iron sheet with welded construction throughout. Automatic wing dampers open with air blast, close weather-tight when not operating. Available as "VD" direct drive with motor mounted inside air stream or as "VDR" with motor mounted outside throat of ventilator — both in a wide range of capacities and sizes.

See Sweet's Architectural File, Section 20b or write for catalog.

ALLEN ENGINEERED VENTILATION
ALLEN COOLER & VENTILATOR INC.
ROCHESTER, MICH.
Roof Ventilators for Every Industrial Need

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Please send me informative literature on your complete line of roof ventilators.

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Position
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RECENT TRADE LITERATURE

Continued

signed to aid engineers in calculations for coil problems. Charts include table of nominal ratings for four-, six-, eight-row coils. Further charts show when coil is operating all wet, partially dry, all dry. *Refrigeration Engineering, Inc., Dept. HPAC, 7250 E. Slauson Ave., Los Angeles 22.*

▶ *WATER CONDITIONING* — Bulletin 4801-A describes versatility, economy features of company's hot lime-zeolite softeners. Deals with method of operation, expected results, chemical savings, simplicity of operation. *Cochrane Corp., Dept. HPAC, 17th St. below Allegheny Ave., Philadelphia 32.*

▶ *WELDING* — 1956 revision of company's No. 150 general welding catalog covers its complete line of oxyacetylene welding and cutting torches, machine cutting torches, regulators, pressure gages, hose connections, couplings, safety equipment. *Modern Engineering Co., Dept. HPAC, 3407 Pine Blvd., St. Louis 3.*

▶ *WELDING* — Manual is designed as pocket "encyclopedia" of practical welding knowhow needed by operating personnel particularly in maintenance departments of industry, welding shops where variety of metal work is more than routine. *All-State Welding Alloys Co., Inc., Dept. HPAC, 249-55 Ferris Ave., White Plains, N. Y.*

▶ *WELDLESS REPAIRS TO IRON, STEEL* — Technical bulletin No. 14 describes company's method of making weldless repairs to iron and steel tanks, conduits, containers, surfaces. Method employs epoxy resin and glass cloth in lamination procedure. *Smooth-On Mfg. Co., Dept. HPAC, 572 Communipaw Ave., Jersey City 4.* ≠

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Series DAW
FOR FLUIDS OR GASES
Bourdon Tube Operated
Hermetically Sealed Contact
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Visible Calibrated Dial
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Operating ranges from 0-14 psig to 0-300 psig with differentials varying from 2 oz. to 14#. Listed as standard by UL (NEMA 1A,2,3,4).
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Series PQ
FOR AIR OR GAS
Very sensitive.—Diaphragm Operated. Available in six operating ranges from 0 to 0.1" pressure to 1 to 30" vac., with varying differentials. Has hermetically sealed contact.
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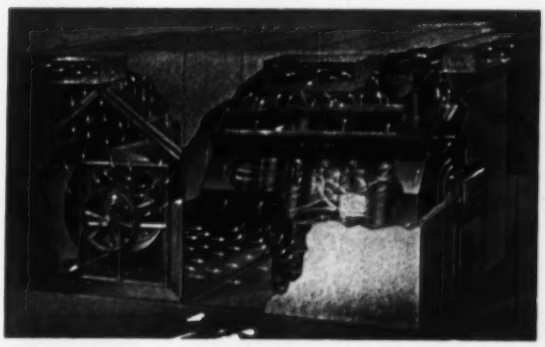
THE MERCOID CORPORATION
4211 Belmont Ave., Chicago 41, Ill.

WARM AIR HEATED... by Campbell

First Methodist Church, Denison, Iowa. A Campbell No. 8100 stoker fired unit was installed in 1948, to replace an old inefficient heating system.

BEST FOR CHURCHES

Campbell Warm Air Heaters meet every requirement for church heating. Low in first cost, easy to install, they operate very quietly and deliver quick abundant heat with amazing fuel economy. Campbell Heaters are available for all fuels in capacities up to 3,150,000 BTUs. On your next church heating job, build your plans around a Campbell 8000 series warm air heater.



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I am interested in your proposition for manufacturers' agents.
My territory covers .....
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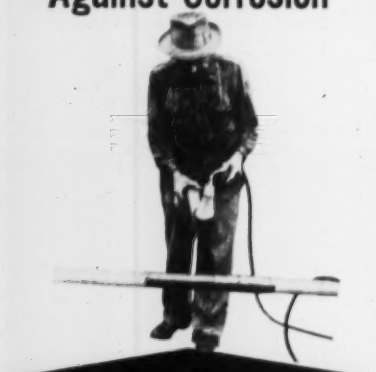
HOW TO CUT APPLICATION COSTS

in Protecting Pipe and Pipe Joints Against Corrosion



Let TAPECOAT do the job without Kettles, Hot Stuff, or Special Crews

When specifications call for hot applied coal tar protection of underground piping as in AWWA specifications C-203 and C-204, and the volume does not justify the cost of shipment to a mill for coating—TAPECOAT offers a practical solution. Here is a widely-accepted alternate material that is equivalent to mill-applied hot coal tar protection.

With this coal tar coating in handy tape form, piping contractors can use their own personnel to do the job because technical know-how and special equipment are not required. You save time and money and eliminate the need for sub-contracting in assuring the long-life protection called for.

TAPECOAT is easy to apply, using a torch to soften and bleed the pitch which provides both bond and protection. Available in widths of 2", 3", 4", 6", 18" and 24", it is spirally wrapped or cigarette wrapped around the vulnerable surfaces.

Since 1941, TAPECOAT has proved its ability to fight corrosion on pipe, pipe joints, mechanical couplings, conduit, cable and insulated piping.

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The TAPECOAT® Company

Originators of Coal Tar Coatings in Tape Form

1555 Lyons Street
Evanston, Illinois

WHO'S WHAT . . .

(New personnel, promotions)

▸ *AIR POLLUTION CONTROL ASSOCIATION*—Benjamin Linsky, administrative control officer for new bay area air pollution control district in San Francisco. Mr. Linsky is president of APCA.

▸ *CONOFLOW CORP.*—Albert J. Hanssen, chief engineer.

▸ *MINNEAPOLIS - HONEYWELL REGULATOR CO.*—K. L. Wilson, vice president.

▸ *REDMOND CO., INC.*—Michael J. Koenig, general sales manager.

▸ *JOSEPH T. RYERSON & SON, INC.*—George B. Howell, manager of sales of tubular products and cold finished steel bars at company's Detroit plant.

▸ *YORK-SHIPLEY, INC.*—T. A. Crawford, director of marketing.

▸ *GENERAL ELECTRIC CO.*—Carter L. Redd, commercial vice president for company's southeastern district; F. C. DeLorenzo, manager of advertising and sales promotion for commercial and industrial air conditioning department.

▸ *MUELLER CO.*—W. R. Leopold, Jr., engineering division manager.

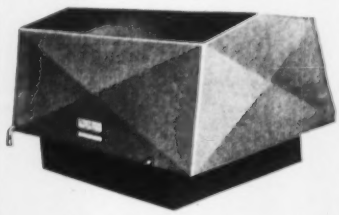
▸ *YORK CORP.*—Sherman Loud, sales manager, national accounts; John G. Reid, engineering manager, absorption systems.

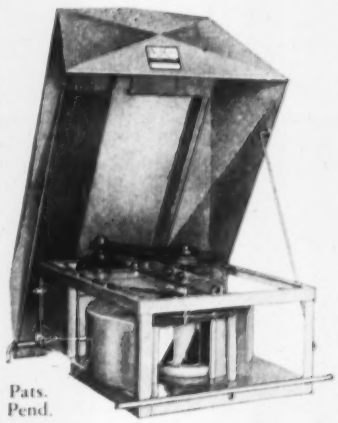
▸ *UNION ASBESTOS & RUBBER CO.*—Max H. Schachner, manager of company's Coldmobile Div.

AirMaster

LO-BOY CENTRIFUGAL ROOF EXHAUSTERS

Enhance The Beauty Of Building Skylines





Pats. Pend.

Lowest Silhouette Design

Forward or Backward Curve Wheel Within . . . . or Out of Scroll Housing

Motor mounting on side of structure support . . . out of line of air stream reduces height of Lo-Boy models nearly 50% of older designs.

LOW WIND RESISTANCE
SIZES 10"-72" 600-47,000
CERTIFIED C.F.M. RATINGS

- **QUALITY**
- **BEAUTY**
- **PROVEN PERFORMANCE**

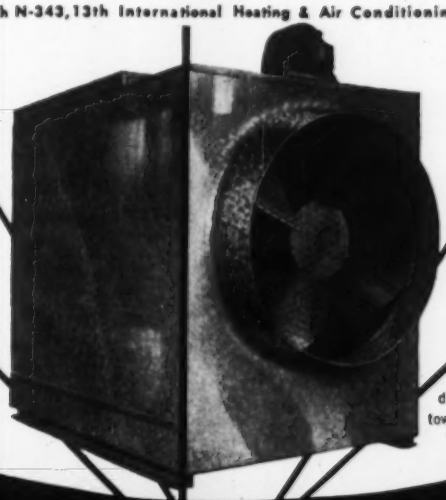
See Sweet's File 20c/Amm or Write for bulletin HA-100 57

AMMERMAN CO., INC.

110 North Second St.

Minneapolis 1, Minnesota

See the Dover Complete Line in Booth N-343, 13th International Heating & Air Conditioning Exposition, Chicago, Feb. 25-March 1, 1957



Series CF horizontal induced draft tower. Vertical induced draft and natural draft towers also available.

DOVER TOWERS

ARE HOT DIP GALVANIZED*

TO STOP RUST COLD!

*After Fabrication

Why Dover Hot-Dip Galvanizes *After* Fabrication

Why doesn't Dover simply use *mill galvanized* steel? The answer is simple — the results are important. Shearing, braking, forming and welding operations on mill galvanized steel tends to destroy the zinc coating, leaving certain spots unprotected. Once the protective zinc coating is removed, rust and corrosion go to work causing costly damage. For this reason, Dover does all the fabricating first, and *then* hot dips the entire assembly. The result is complete protection against rust and corrosion.

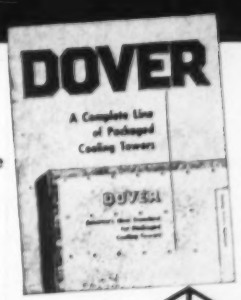
No Costly Rust, Corrosion No Unsightly Appearance

Dover packaged cooling towers, 2 to 100 tons capacity, are hot-dip galvanized after fabrication for two very important reasons; first, to provide you with a cooling tower that will not be damaged by costly rust and corrosion. Second, to provide you with a tower that will stay new looking after many months of use.

ONLY DOVER GIVES YOU THIS COMPLETE ASSURANCE AND PROTECTION AT NO ADDITIONAL COST!

FREE OFFER

Send today for a copy of Dover Catalog. Gives all the facts and specifications of Dover's complete line.



DOVER PACKAGED COOLING TOWERS MEET THE RIGID REQUIREMENTS OF THE NEW YORK CITY DEPARTMENT OF BUILDING

DOVER Mfg. Co.

Dept. 100 3117 Weatherford Ave., Independence, Missouri

☐ Send copy of Dover Catalog.

☐ Send name of nearest Dover representative.

NAME _____

FIRM _____

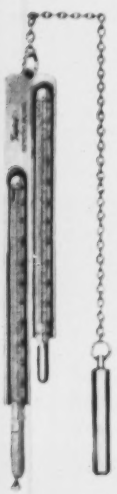
ADDRESS _____

CITY _____ ZONE ___ STATE _____

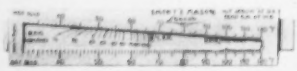
HOW DAMP IS DAMP ?

4 WAYS TO TELL WITH *Taylor*

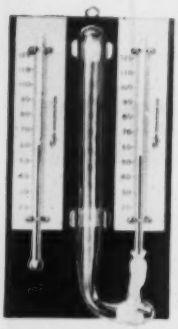
Taylor Sling Psychrometer. The standard hygrometer for accurate measurement of relative humidity—redesigned for even simpler operation. New 9″ Gold Back etched-stem thermometers accurate within one scale division. New rigidly attached swivel handle folds back when not in use. Variety of F. and C. ranges available.



Pocket Sling Type Psychrometer—sturdy metal mounting is 5″ long for convenience, has sturdy chain and handle for ready use. Range: 20° to 120°F. 1° divisions.



HYGRORULE eliminates need for cumbersome tables, translates wet and dry bulb readings into relative humidity values accurate within ± 1% of table readings. One side calibrated for sling psychrometers, the other for still-air hygrometers. 6″ long, leather case.



Mason's Form Hygrometer is made for wall mounting in office, factory or home. Magnifying mercury or PERMACOLOR*-filled tubes, ranges from 30° to 220°F. Black markings on white scale. Mahogany or gray metal mounting. Complete with humidity tables and spare wick. 8½″ x 4½″. Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada.

*Reg. U. S. Pat. Off.

Taylor Instruments
MEAN ACCURACY FIRST

WHO'S WHAT — *Continued*

▸ *UNITED STATES AIR CONDITIONING CORP.*—R. L. Kirse, Jr., service manager.

▸ *DRAVO CORP.*—Walter L. Davidson, manager of heaters, crane cab conditioning equipment and industrial grating for company's machinery division.

▸ *CHASE BRASS & COPPER CO., INC.*—Frank P. Strong, assistant treasurer.

▸ *SQUARE D CO.*—Wilbur H. Peter, Jr., a vice president and division manager of electric controller division in Cleveland; Walter Nollenberger, manager of new manufacturing plant to be built at Lexington, Ky.; Stephen Kovach, manager of smaller regional assembly plant now under construction in Atlanta.

▸ *WORTHINGTON CORP.*—Nathan A. Gardner, chairman of foreign trade committee of Air-Conditioning and Refrigeration Institute. Mr. Gardner is manager of air conditioning and refrigeration sales, export department, for Worthington.

▸ *INLAND STEEL PRODUCTS CO.*—Duane Elmore, chief engineer.

▸ *BRYANT DIV., CARRIER CORP.*—William Gaskell, a director of Oil-Heat Institute of America, Inc., and also head of oil fired furnaces committee for OHI.

▸ *JOHNSON SERVICE CO.*—Joseph H. Mason, to executive staff of general sales department. Mr. Mason's duties will include supervision of the company's technical recruiting program and liaison work with engineering colleges and technological institutes.

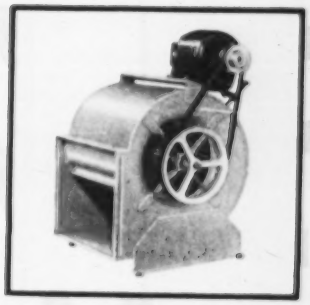
▸ *McQUAY, INC.*—Roger K. Mattson, manager of mechanical contractor and industrial coil sales.

▸ *DRAYER-HANSON INC., DIV. OF NATIONAL-U.S. RADIATOR CORP.*—Robert D. Zechar, personnel manager.

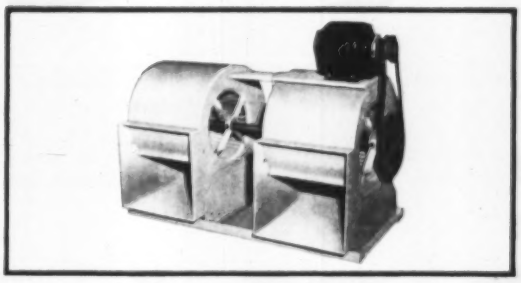
▸ *WHIRLPOOL-SEEGER CORP.*—John F. Zubrod, product manager of air conditioning division.

▸ *PECK, STOW & WILCOX CO.*—Ronald J. Ahern, president and general manager.

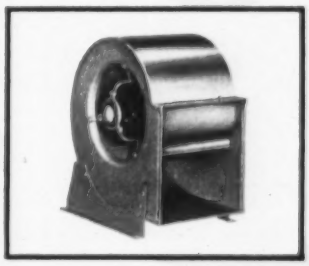
THERE'S A BRUNDAGE BLOWER FOR EVERY NEED



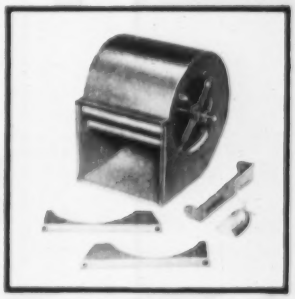
SERIES 'X'



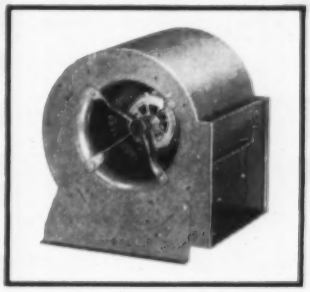
TWINS



DIRECT DRIVE



UNIVERSAL



POWER CENTER

When you want to move air — reliably and efficiently — look to the Brundage Blower line. You'll find a wide range of blower types and sizes to meet your design requirements — plus 24 hour shipment on all stock models. *Write for complete catalog.*

BRUNDAGE BLOWERS | Quality since 1919

The BRUNDAGE Company
512 N. Park Street, Kalamazoo, Mich.
Phone 2-0251

OPELOUSAS GENERAL HOSPITAL, OPELOUSAS, LOUISIANA • TEMPLE EMANU-EL, DALLAS, TEXAS • HULL #2290, NEW YORK, N. Y. ROWAN BUILDING, FORT WORTH, TEXAS EDWARD R. HARRIS, MARACAIBO, VENEZUELA HOTEL LOGAN, OMAHA, NEBRASKA • NURSES RESIDENCE, LOS ANGELES COUNTY HOSPITAL ERICKSON MOTEL, CROOKSTON, MINNESOTA TINY TOT STORE, FREEPORT, ILLINOIS

Universal Versatility

Recessed Type

Console Model

drayer-hanson

SPOTAIRE-VRC

AIR CONDITIONING

...one of seven complete lines of year-'round air conditioning equipment

Need literature?

drayer-hanson

3301 Medford Street • Los Angeles 63, California

(Division of National-U.S. Radiator Corporation)

WHO'S WHAT

Continued

▸ *SHAW-PERKINS MFG. CO.*—Edward Davies, advertising manager.

▸ *BABCOCK & WILCOX CO.*—Millard A. Hammond, manager of welding fittings sales for Tubular Products Div.

▸ *DOLE REFRIGERATING CO.*—Harold P. Hansen, assistant general manager; George E. Frankel, secretary-treasurer; John E. Hutchinson, general sales manager; Bruce P. Tweed, head of research and product development division. O. L. Rose, formerly vice president, secretary-treasurer and assistant general manager, has gone into partial retirement.

▸ *ACME INDUSTRIES, INC.*—Duane G. Merrill, sales manager, field sales.

▸ *IRON FIREMAN MFG. CO.*—Howard M. Cutshaw, general sales manager; Roy. F. Renoud, employee relations director.

▸ *TYPHOON AIR CONDITIONING CO., DIV. OF HUPP CORP.*—Edmund G. Seergy, manager of national account sales.

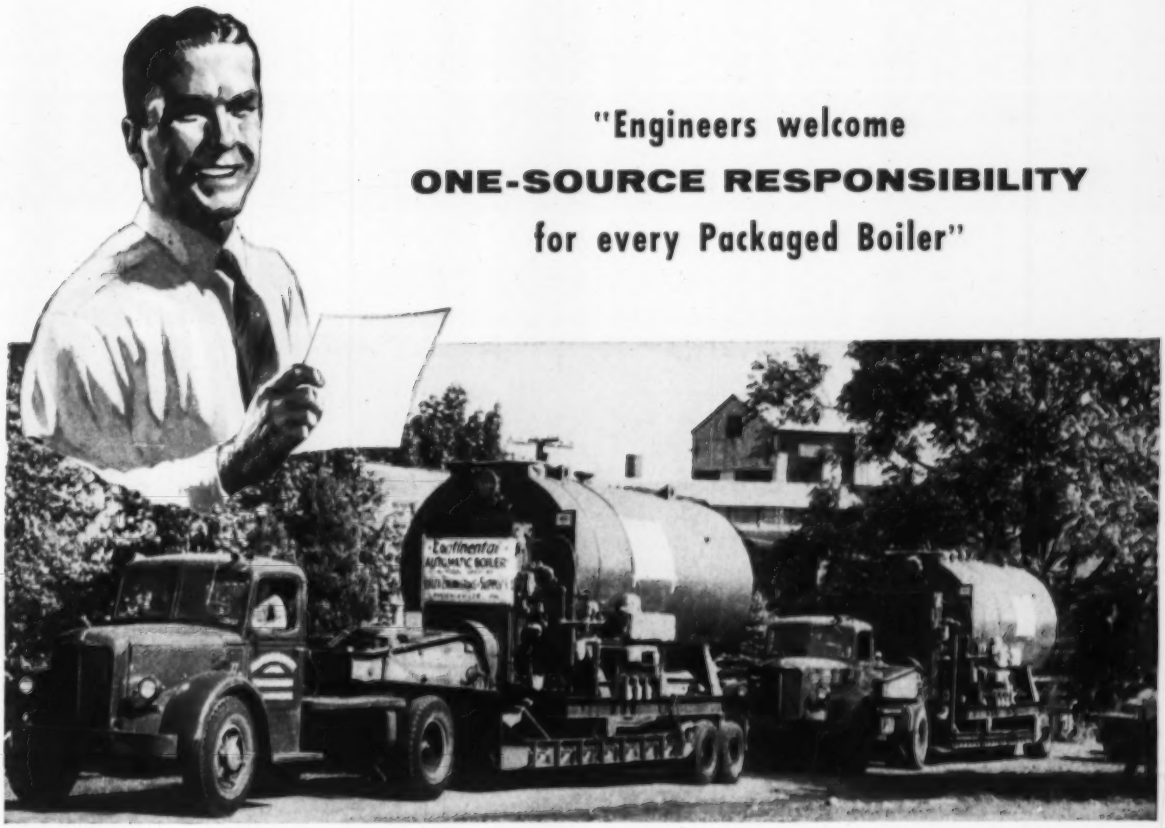
▸ *SOUTHWEST RESEARCH INSTITUTE*—Dr. Edward Wenk, Jr., chairman of department of engineering mechanics.

▸ *TAYLOR INSTRUMENT COMPANIES*—Harry G. Olson, divisional manager in charge of industrial instrument sales to processors in air conditioning, refrigeration, textile and metal industries; Frank S. Ward, administrative assistant to the president; L. Lawrence Forward, manager of company's Chicago operation; Albert J. Fleig, assistant to Mr. Forward; George Heller, industrial sales manager.

▸ *HEMEON ASSOCIATES*—Harold M. Ide, to head up activity concerned with area surveys and laboratory investigations for the air pollution consulting firm.

▸ *COLEMAN CO., INC.*—W. L. Rowe, director of manufacturing; A. M. Castello, sales engineering manager; Robert H. Lowe, advertising and sales promotion manager.

▸ *A. Y. McDONALD MFG. CO.*—Robert E. Sage, general sales manager of factory products divisions.



"Engineers welcome ONE-SOURCE RESPONSIBILITY for every Packaged Boiler"

"As an engineer, I want to know who is responsible for the trouble-free performance of every boiler I specify. With a built-up fire-tube boiler, each component may have a different manufacturer. When service is needed, it's often impossible to pinpoint responsibility.

"But with a Packaged Boiler, it's easy. The company on the nameplate is the one reliable source of responsibility for uninterrupted, smooth, economical functioning of every part. To a busy engineer and a busy plant, the single source of responsibility for Packaged Boiler operation is a factor that cannot be overemphasized.

"So, for completely dependable, low-cost performance . . . and one-source responsibility whenever the need arises . . . I know I can rely on Packaged Boilers for every heating and processing need."

Six Reasons Why it Pays to Buy a

CONTINENTAL

Automatic Boiler

* Guaranteed 80% efficiency . . . Fire-tested before shipment . . . Range, 20 to 500 hp.
* Simple, practical two-pass design, for uniform flow of combustion gases through all return tubes.
* Maximum radiant heat transfer achieved by "Spinning Gas" technique for thorough mixing of air and atomized fuel.
* High-CO_2 and low-temperature stack gases — proof of high combustion efficiency.
* Free, rapid water circulation improves heat transfer, keeps heating surfaces clean.
* Easy access to furnace and all return tubes. Refractory baffles and brickwork are not required.

For details on the Continental Automatic Boiler, send for Bulletin BE-3

BOILER ENGINEERING & SUPPLY COMPANY, INC.

8 Manavon Street, Phoenixville, Pa.

A HALF CENTURY OF BOILER MANUFACTURING EXPERIENCE

The Continental AUTOMATIC BOILER

WHO'S WHAT

Continued

Bruce McDonald and Robert McDonald, sons of D. L. McDonald, president of the company and grandson of the founder, have joined the firm. Both have recently been discharged from the Armed Forces.

▸ *BROOKS ROTAMETER CO.*—Robert F. Gilman, production engineer; Henry F. Lorence, advertising manager.

▸ *OSTER MFG. CO.*—Roger Tewksbury, chairman of the board; T. S. Bonnema, president and general manager.

▸ *AIR-CONDITIONING AND REFRIGERATION INSTITUTE*—G. T. Kellogg, assistant to director of public relations.

▸ *DRAYER-HANSON, INC.*—Andrew Gonzales, assistant to sales manager; William Randall, sales engineering trainee.

▸ *CRANE CO.*—Donald F. Dickinson, manager of newly formed manpower development department.

▸ *READING TUBE CORP.*—William C. Kelly, purchasing agent.

▸ *DUST SUPPRESSION AND ENGINEERING CO.*—Elbridge H. Smith, assistant chief engineer.

▸ *HUPP CORP.*—Fred W. Hottenroth, vice president in charge of technical sales.

▸ *BORG-WARNER CORP.*—Lawrence T. Peifer, administrative vice president of Atkins Saw Div.

▸ *LEWYT AIR CONDITIONER CORP.*—Stanley Silber, director of sales.

▸ *OLIN MATHIESON CHEMICAL CORP.*—U. R. Jaeger, sales manager for "Roll-Bond" products in company's Western Brass Div.

▸ *JOSEPH T. RYERSON & SON, INC.*—Joseph D. Gavin, manager of sheet and strip order department at Chicago steel service plant.

▸ *MUELLER CLIMATROL*—Robert F. Hume, director of purchasing.

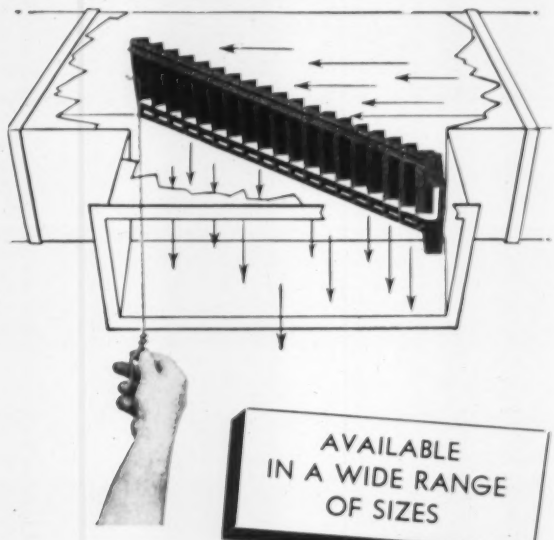
NOW . . . *Divert Air Where You Want It!*

A-J

AIR "EXTRACTOR"

This new A-J Air Extractor gives you maximum control of any forced air system. It's not a "damper type" control to meter available air flow through a grille, but a "scoop" that diverts air from the main duct to branch ducts or grilles and increases output over normal flow where needed.

The curved steel blades of the A-J Extractor are adjustable and act in unison to provide a controlled and uniform flow of air in branch ducts. A single key rod provides fast and easy adjustment through the face of a grille or register, and eliminates need for removal. The extractor is sturdily constructed, and fastened in the duct with two screws. Velocity of the air will not alter setting. Write for full information and prices.



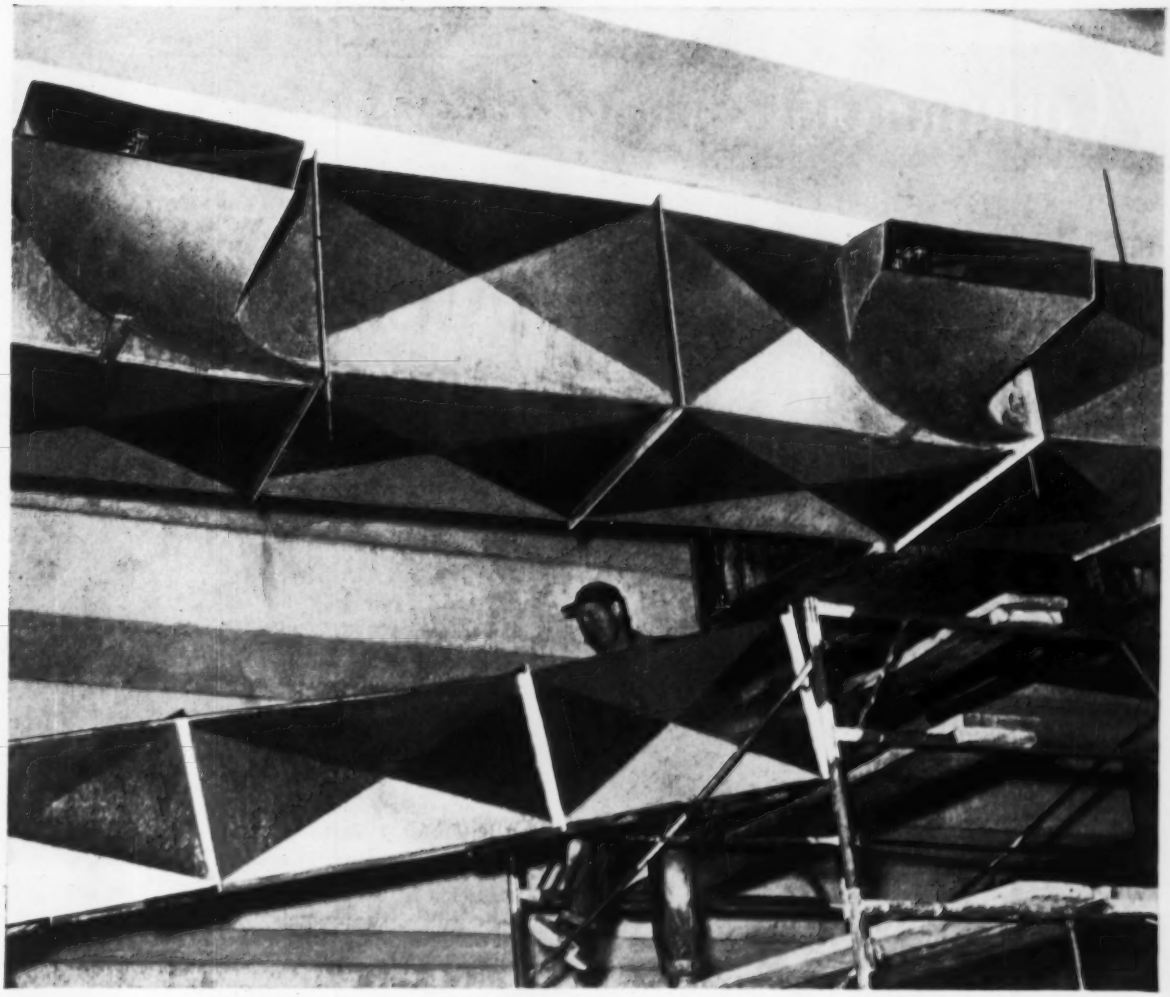
AVAILABLE IN A WIDE RANGE OF SIZES

FREE Catalog

listing, describing and pricing 1,000 types and sizes of grilles, registers, etc.

A-J MANUFACTURING Co.

3601 E. 18th St. Dept. H-11 Kansas City 27, Mo.



This coating goes wherever the base metal goes

You can put Bethcon galvanized steel sheets through the toughest kind of forming without flaking or peeling of the zinc coating. Snap locks, Pittsburgh locks, or your own special seams—they're all the same to a Bethcon sheet!

That's because Bethcon is galvanized in Bethlehem's continuous lines, which bond the zinc more tightly to the base metal than conventional hot-dipping processes. With a Bethcon sheet, you'll find that the coating goes wherever the base metal goes and comes out just as sound as it started.

There's another advantage in Bethcon, too: the improved appearance and sales appeal of the finished product. Bethlehem's continuous galvanizing process imparts brighter, more uniform spangles to the sheet. It also distributes the zinc more evenly over the surface, eliminating those heavy beads which you so often find on the drip end of conventional galvanized sheets.

You can specify Bethcon in cut lengths or coils, 16-gage or lighter. You can also choose between plain carbon steel and corrosion-resisting Beth-Cu-Loy (copper-bearing steel) for the base metal, depending on the requirements. If you would like more details about Bethcon, our nearest district office will be glad to make them available.

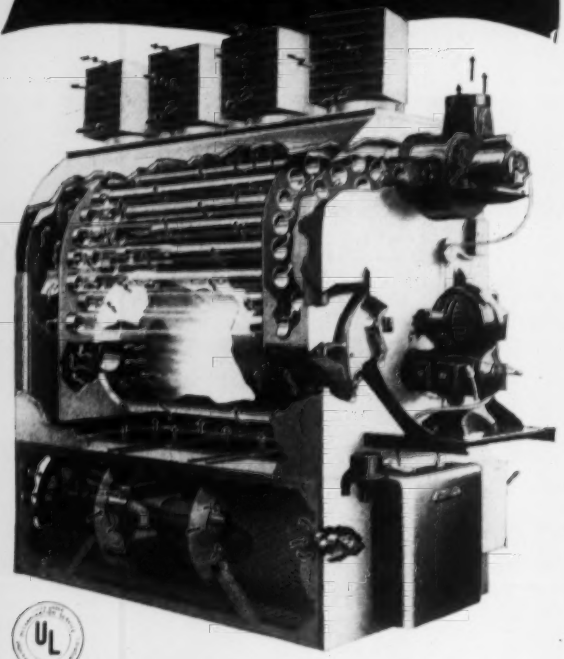
BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

Commercial-Aire



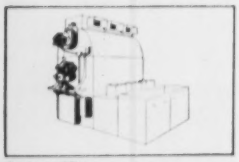
DIRECT-FIRED

Space Heaters

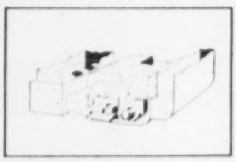
300,000 BTU's

TO 2,000,000 BTU's

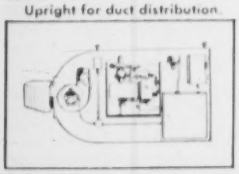
Provides industry with lowest cost heating. Primary cylindrical stainless steel combustion chamber, secondary heat-extracting tubes, consistent rate of combustion gas flow provide high efficiency, utilizing 80% of available heat of fuel. Highly adaptable to desired mounting arrangements. Features low first cost, easy maintenance, complete accessibility to all service points. Completely equipped and wired with controls for economical installation.



Series "FD"
Upright for duct distribution.



Series "HD"
Horizontally for duct distribution.



Series "H"
Horizontally suspended.

Series "U"
Inverted suspended.

MAMMOTH FURNACE CO.
6425 Cambridge St.
Minneapolis, Minn.

Send full details, prices, delivery dates, etc., on Commercial-Aire Heaters.

NAME_____

ADDRESS_____

CITY_____ ZONE____ STATE_____

WHO'S WHAT

Continued

▸ *HUCK MFG. CO.*—George Q. Mathews, vice president in charge of sales.

▸ *DELAVAN MFG. CO.*—Don Sill, project engineer in jet aircraft nozzle department.

▸ *PEERLESS ELECTRIC CO.*—Richard J. Boozel, industrial relations manager.

▸ *SPENCER THERMOSTAT DIV., METALS & CONTROLS CORP.*—Burton O. Haun, field sales manager.

▸ *SURFACE COMBUSTION CORP.*—Quinten Kenny, publicity manager in advertising department of industrial division.

▸ *FAIRBANKS, MORSE & CO.*—V. H. Peterson, vice president in charge of engineering; Gordon Anderson, Jr., assistant chief engineer; William B. Morse, assistant to coordinator of government business.

▸ *MITCHELL MFG. CO.*—Robert Sheridan, manager of products and sales development in commercial and residential air conditioning division; W. J. Cotsakis, Jr., personnel director; Elmer Smith, director of procurement.

▸ *INSTRUMENT SOCIETY OF AMERICA*—Justus T. Vollbrecht, national president. Mr. Vollbrecht is president of Energy Control Corp.

IN THE TERRITORIES . . .

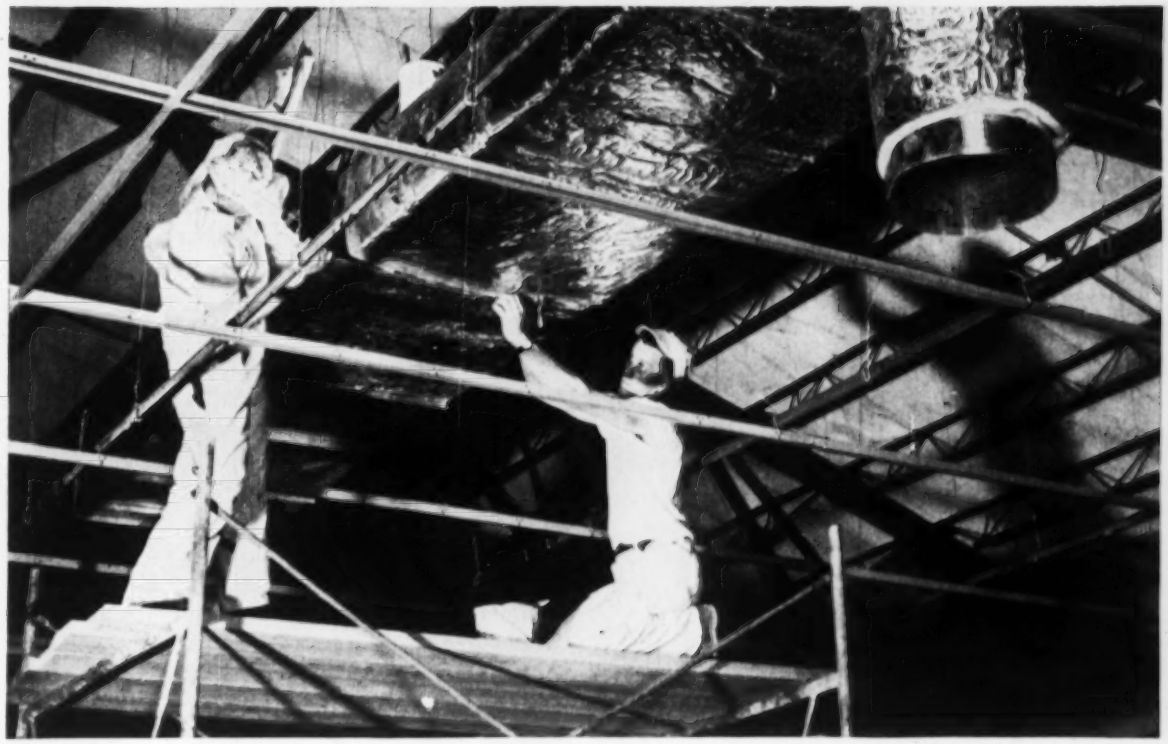
(Recent sales appointments)

▸ *CLEAVER-BROOKS CO.*—Appointed manufacturers' representatives are: Miller & Chitty Co., for northern New Jersey, Staten Island; Jim Marshall Sales Engineering Service, for southern Texas.

▸ *AIRTEMP DIV., CHRYSLER CORP.*—R. S. Martin, district manager, west coast region; M. L. Franzel, St. Louis assistant regional manager; Pugh Heating & Air Conditioning Co., Toledo area distributor for commercial air conditioning equipment.

▸ *UTILITY FAN CORP.*—Marc W. McGuire, sales engineer. His primary duties will be the training of salesmen in the field and conducting sales meetings for distributors from coast to coast.

INSULATION News from L·O·F GLASS FIBERS COMPANY



"Foil-faced Microlite cuts installation costs . . . boosts insulating efficiency"

—*says John Hayes, Service Products, Inc., Toledo, Ohio.*

Service Products, Inc., used foil-faced Microlite to prevent condensation on sheet metal air-conditioning ducts in Toledo's University Bowling Alleys. Working on scaffolds, the men brushed adhesive on ducts where edges of insulation butted together, and sealed the handy attached 2" tabs with adhesive . . . all more quickly than is possible with other blanket-type insulating materials!

Look at all the dollar-saving advantages you get from Microlite . . .

- *Easy to handle on scaffolds*—extremely light in weight!
- *Easy to cut and fabricate*—eliminates the need for precision cutting and fitting and for special skills and tools!
- *Resists tearing*—high tensile strength allows workmen to pull it through tight spots safely!
- *Economical to store*—compression-packed rolls take up a fraction of the space of ordinary insulations.

Microlite is one of the most effective insulations known. It is made from countless fine glass fibers which form millions of sound- and heat-trapping air cells. What's more, these glass fibers won't rot or burn!

Microlite is available with foil, vinyl and other plain or reflective facings, extended beyond edges of insulation to form tabs. For full details, check the Yellow Pages for the nearest distributor; or write: L·O·F Glass Fibers Company, Dept 39-116, 1810 Madison Avenue, Toledo 1, Ohio.

LOF GLASS FIBERS MICROLITE INSULATION

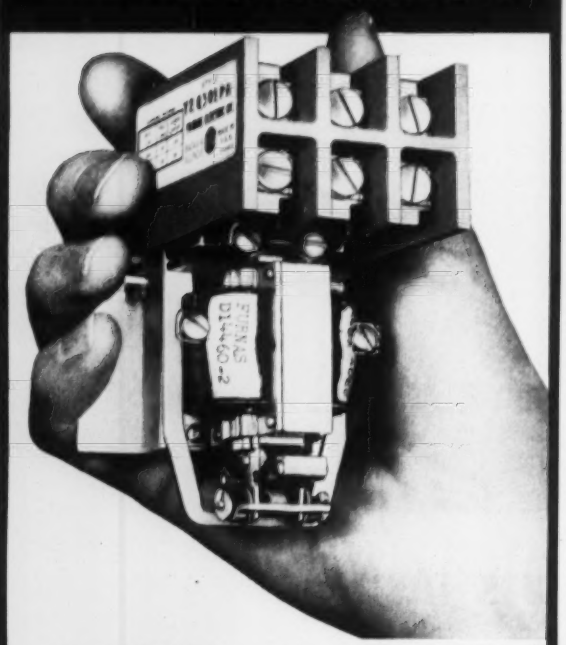
L·O·F GLASS FIBERS COMPANY

TOLEDO 1, OHIO

Makers of glass fibers by the "Electronic-Extrusion" process

FURNAS ELECTRIC CONTROLS

do the best job for AIR CONDITIONING and REFRIGERATION



NEW—4 SIZES

For the first time, an ampere size to match your single and polyphase starter requirements for current rated motors through 550 volts. Now you can choose from 20-30-35-50 ampere sizes. Look for these features: 1—Each pole carries full current—no poles connected in parallel. 2—Silver Cadmium Oxide contacts—longer life. 3—Magnets require less watts thereby reducing transformer sizes and thermostat contact load—savings in cost and space.

WRITE TODAY FOR BULLETIN 5610—1041 McKEE STREET, BATAVIA, ILLINOIS

A7

FURNAS ELECTRIC COMPANY

BATAVIA, ILLINOIS

Sales Representatives in all Principal Cities

WHO'S WHAT

Continued

▸ *BABCOCK & WILCOX CO.*—For Tubular Products Div.: Millard A. Hammond, manager of welding fittings sales with headquarters at Milwaukee; Ralph R. Ryan, sales representative for Detroit district.

▸ *YORK CORP.*—Anthony G. Mazzeo, sales manager for York-New Jersey Distributors, Inc.

▸ *SERVEL, INC.*—Zintel-Devitt Co., representative for absorption water chilling equipment in Chicago.

▸ *PACIFIC STEEL BOILER DIV., NATIONAL-U. S. RADIATOR CORP.*—Representatives and territories are: J. Edwin Aspinall Co., Indiana, southeastern Illinois; Arco Engineering Co., Kentucky, westward from Lexington.

▸ *CORY CORP.*—Frank Pollitt, territory manager for Minneapolis-St. Paul and Duluth, plus states of Minnesota, the Dakotas, western Wisconsin, eastern Montana; Will Wisler, assistant territory manager for Chicago, northern Illinois, northern Indiana.

▸ *BLACK & DECKER MFG. CO.*—Robert E. Stone, Jr., Los Angeles industrial-automotive division district manager.

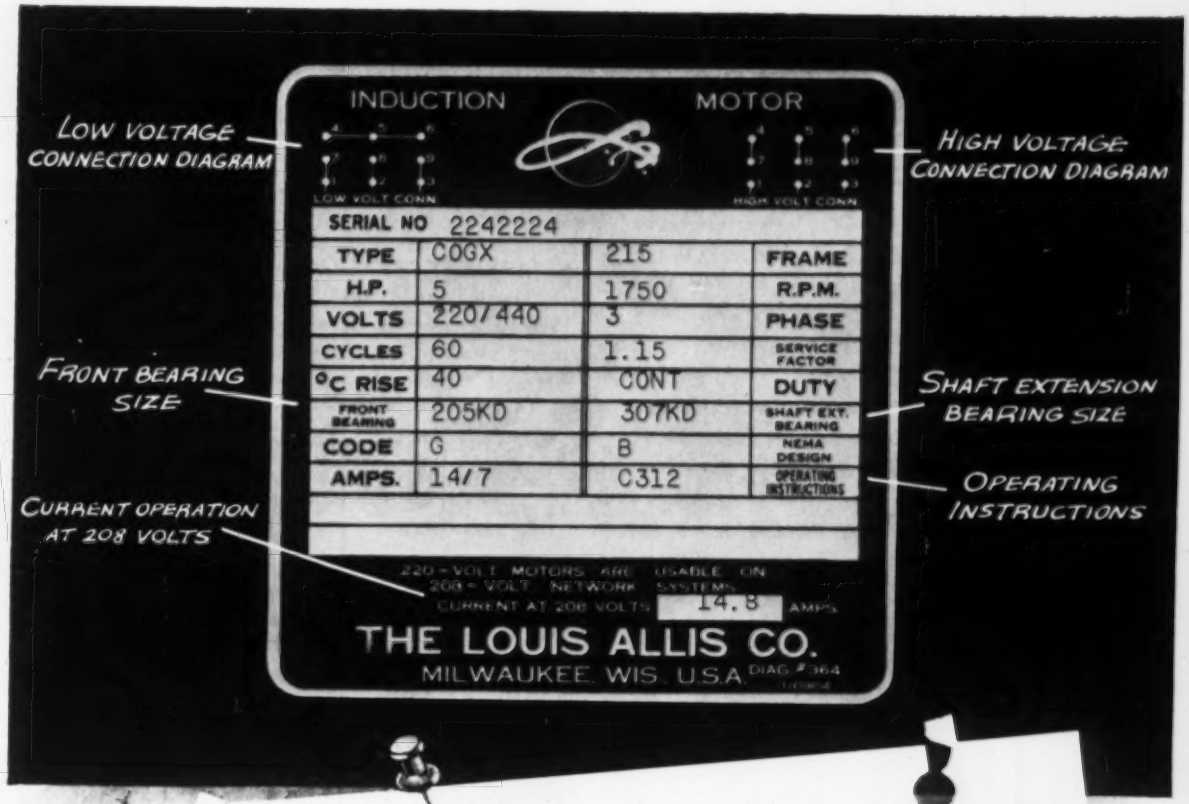
▸ *WARNER ELECTRIC BRAKE & CLUTCH CO.*—Harry Binks, midwest branch sales manager; Richard Greene, representative for St. Louis.

▸ *IRON FIREMAN MFG. CO.*—Gurth Baldwin and Richard H. Byers, managers of company's sales and service branches at St. Louis and Cleveland, respectively.

▸ *SPORLAN VALVE CO.*—Harold V. Clyde, manager of company's new Cleveland office to service Cleveland-Pittsburgh trading area.

▸ *A. M. BYERS CO.*—Wilkins Pipe and Supply Co., distributor for wrought iron pipe in Peoria, Ill., area.

▸ *VIKING AIR PRODUCTS DIV., NATIONAL-U.S. RADIATOR CORP.*—Malcolm F. MacKenzie, account executive for heating manufacturers in Wisconsin, Illinois, metropolitan St. Louis; Clifford Woodruff, district sales manager for heating, electrical appliance distributors in same area; William Siebenthaler, district sales manager for Texas, Oklahoma, Kansas, eastern Missouri.


LOW VOLTAGE CONNECTION DIAGRAM
INDUCTION MOTOR
HIGH VOLTAGE CONNECTION DIAGRAM
LOW VOLT CONN
HIGH VOLT CONN
SERIAL NO 2242224
TYPE COGX 215 FRAME
H.P. 5 1750 R.P.M.
VOLTS 220/440 3 PHASE
CYCLES 60 1.15 SERVICE FACTOR
°C RISE 40 CONT DUTY
FRONT BEARING SIZE
FRONT BEARING 205KD 307KD SHAFT EXT. BEARING
SHAFT EXTENSION BEARING SIZE
CODE G B NEMA DESIGN
AMPS. 14/7 C312 OPERATING INSTRUCTIONS
OPERATING INSTRUCTIONS
CURRENT OPERATION AT 208 VOLTS
220-VOLT MOTORS ARE USABLE ON 208-VOLT NETWORK SYSTEMS.
CURRENT AT 208 VOLTS 14.8 AMPS.
THE LOUIS ALLIS CO.
MILWAUKEE, WIS. U.S.A.
DIAG. #364

why is this nameplate important to you?

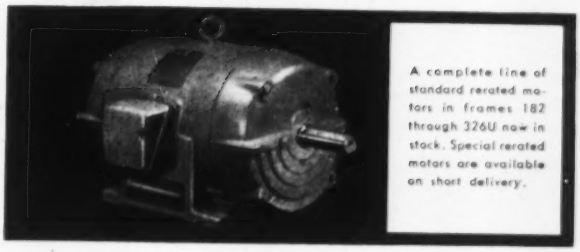
It provides visible evidence that Louis Allis standard motors are built with special care to run better, last longer . . .

Look at the information on this nameplate—information that makes life a lot easier for the user. And to keep this information available at all times, we make this nameplate out of corrosion-resistant stainless steel.

Yes, in the new LA line of standard motors, even the nameplate gets special attention from our engineers. And here's what it means to you:

- The rerated frame size shown means more horsepower from motors with smaller outside dimensions. Performance has been improved by new materials and manufacturing methods.
- Spare bearings can be easily ordered from bearing size and type designations on nameplate, thus eliminating disassembly of motor to determine bearing size. Bearings used are conservatively rated for long life.
- No more lost connection diagram since this information is simply and clearly shown on nameplate. This combined with permanent lead markings, assures that correct motor connections can always be made.
- 220/440 volt motors are suitable for operation on 208 volt systems and full load current for 208 volt operation is included on the nameplate. This eliminates need for original equipment manufacturers to carry a stock of 208 volt motors.

Because they are built with special care, new LA standard motors can do a lot more for you. New bulletin No. 1700 shows you why—just write for your copy.


A complete line of standard rerated motors in frames 182 through 326U now in stock. Special rerated motors are available on short delivery.

LA-104

THE LOUIS ALLIS CO.
MILWAUKEE 7, WISCONSIN

WHO'S WHAT

Continued

▸ *NIAGARA MACHINE AND TOOL WORKS*—Frank L. Kelsey, manager of newly established district office at Indianapolis.

▸ *TORIT MFG. CO.*—Edward V. Schuerer, district representative in Wisconsin, upper peninsula of Michigan for sales and service of unitized dust collection equipment.

▸ *J. F. PRITCHARD & CO. OF CALIFORNIA*—R. J. Clark Equipment Co., Inc., sales representative in Florida.

▸ *REFRIGERATION ENGINEERING, INC.*—R & R Refrigeration Corp., distributor for refrigeration and air conditioning equipment in Lubbock, the south plains and panhandle area of Texas.

▸ *CENTURY ELECTRIC CO.*—J. P. Hoffberger, district manager of Hartford, Conn., office.

▸ *INLAND STEEL PRODUCTS CO.*—Henry E. Storck, sales engineer in District of Columbia, parts of Maryland, Virginia, West Virginia.

▸ *DENNIS CHEMICAL CO.*—G. J. Crowdes, district manager in charge of Ohio regional office.

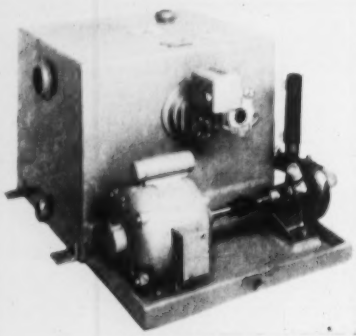
▸ *UNITED STATES GAUGE, DIV. OF AMERICAN MACHINE AND METALS, INC.*—M. S. Jacobs & Assoc., Inc., Pittsburgh distributor.

▸ *BARNEBEY-CHENEY CO.*—R. D. Marshall of R. D. Marshall and Co., Inc., sales representative for "PurAir" activated charcoal air purification equipment throughout upstate eastern New York, southern Vermont, western Massachusetts.

▸ *JOSEPH T. RYERSON & SON, INC.*—William J. Cleary, manager of tubular steel products and cold finished steel bar sales at Philadelphia steel service plant.

▸ *ALLIS-CHALMERS MFG. CO.*—R. H. Cline, manager of Pittsburgh district of company's industries group. He succeeds J. K. Keough, who continues as special representative reporting to V. L. Spinney, manager of central region. Mr. Cline is succeeded as Charlotte district manager by C. B. Rumble, Jr.

▸ *CLARK CONTROLLER CO.*—E. A. Irion, district application engineer in company's Pittsburgh office.



Your Best Buy In Condensate Pumps

Is The

EAGAN EAGLE!

This high quality unit offers you these outstanding advantages: *low initial cost; far more capacity than any other similar pump at the same price* (to 8000 sq. ft. EDR at 20 psi); *a low return inlet* (to eliminate need for a pit even though return lines are as low as a foot above the floor); *all bronze centrifugal pump* with a nonclogging open impeller, stainless steel shaft; *flexible connectors and coupling* (to isolate the pump, eliminate pipe cramp, wear and noise); *thermal overload protection; a level indicating float switch.*

These advantages — and many more — are yours for the asking with the Eagan Eagle. (other models available with capacities to 100,000 sq. ft. at 200 psi.)

Write for Bulletin and prices.

WALTER H. EAGAN CO., INC.

Pump Specialists Since 1920

2337 Wallace Street

Philadelphia 30, Pa.

Send me information on the EAGAN pumps checked:

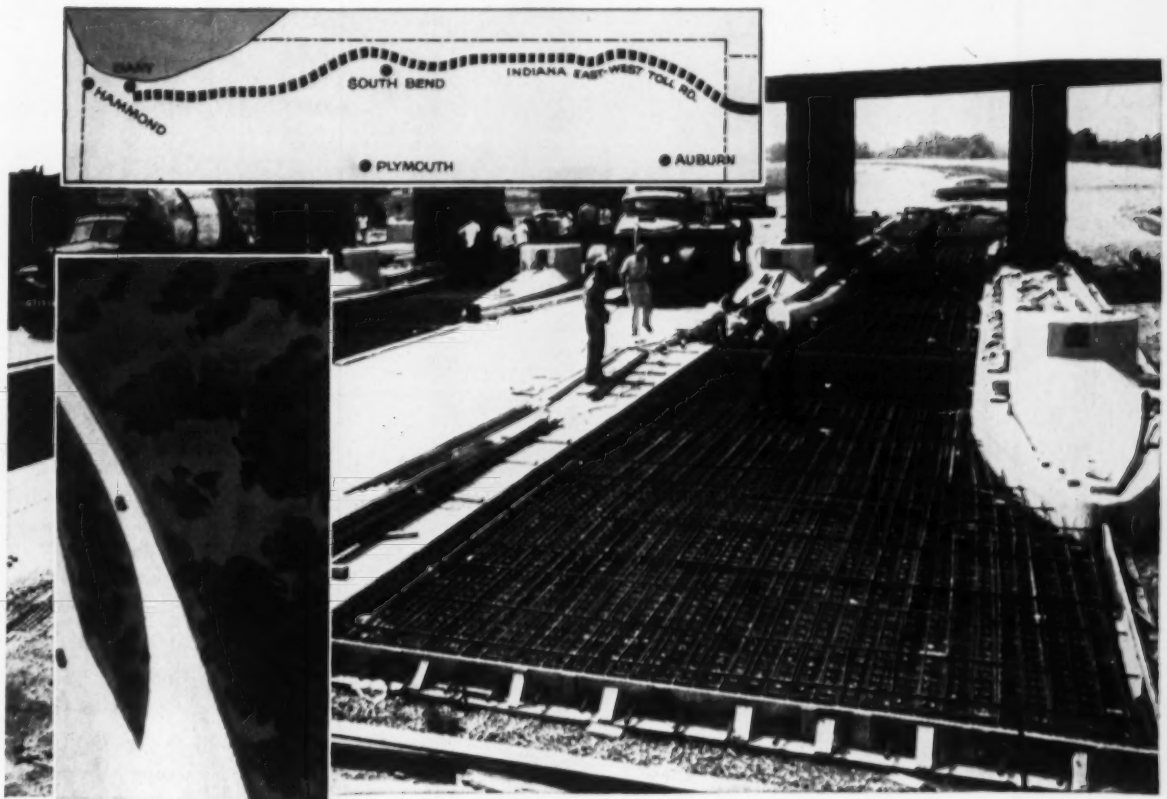
——Condensate ——Boiler Feed ——Centrifugal ——Turbine
——Fuel Oil Pump & Heater Sets

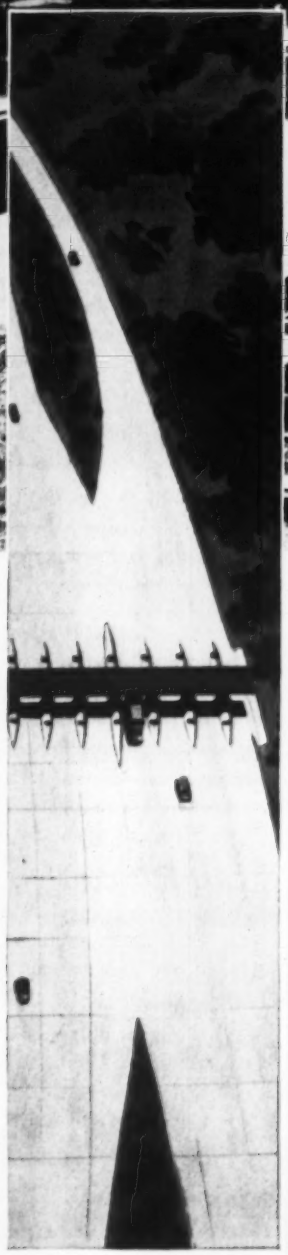
Name .....

Address .....

City ..... Zone ..... State .....

NEW...Snow-and-Ice-Free Interchanges on Indiana's East-West Toll Road





with Steel Pipe Snow Melting Systems

"Really *new* and *important*"... "an *innovation* in highway construction" ... are some of the things said about the Steel Pipe Snow Melting Systems installed at gates and interchanges on the recently opened Indiana East-West Toll Road. That they will add immeasurably to bad weather safety factors and increase the traffic handling capacities at these vital points of entry and exit is the opinion of highway engineers.

With the forthcoming expansion of the nation's highway systems, roadbuilders in the snow belt should give serious consideration to the advantages of automatic snow and ice melting in highway construction ... for interchanges, bridge floors, elevated ramp sections, over-passes, and other exposed road sections where conventional control methods may be both costly and inadequate.

For such installations, *Steel Pipe is first choice*, as in this Indiana road, the elevated approach to the New York Port of Authority bus terminal, the Staten Island Ferry Ramp, and many others. Yes, steel pipe is the most widely used pipe in the world, for snow melting, radiant heating, plumbing, fire sprinkler systems, power, steam, air transmission and electrical raceways.

Write today for free booklet "Steel Pipe Snow and Ice Removal Systems."

Steel Pipe is First Choice

Committee on
STEEL PIPE RESEARCH
AMERICAN IRON AND STEEL INSTITUTE
150 East Forty-Second Street, New York 17, N.Y.

Type F
Slot
STRIPLINE DIFFUSERS by AGIAIR
Slot
Type S
STRIPLINE combines the best features of both slots and efficient
air diffusers to provide equalized air flow throughout its entire length.
STRIPLINE slot diffusers are slenderly designed, inconspicuous, practical and versatile.
These slot diffusers can be located in walls, ceilings, coves, moulds, window reveals
and stools or almost anywhere to suit interior design.
Type H
Write for complete Stripline Catalog.
AIR DEVICES INC. • 185 MADISON AVENUE • NEW YORK 16, N. Y. • AIR DIFFUSERS • FILTERS • EXHAUSTERS

WHO'S WHAT

Continued

▸ *DRAVO CORP.*—Howard A. Vernay, Jr., and Charles E. Snyder, regional managers for heaters and crane cab conditioners for New York and Chicago, respectively.

▸ *ADDISON PRODUCTS CO.*—R. C. Robertson, to direct sales activities in Chicago, surrounding territory.

▸ *ALLEGHENY LUDLUM STEEL CORP.*—I. R. Leheney, district manager in company's Cleveland district sales office. To assume his new duties January 1, Mr. Leheney will succeed W. R. Kuhn, retiring.

▸ *De LAVAL STEAM TURBINE CO.*—H.A. Besocke, manager of new sales branch office in Moline, Ill.

▸ *RELIANCE ELECTRIC AND ENGINEERING CO.*—William K. Schlotterbeck, manager of new Dallas district office; Walter L. Brehmer, district manager of newly created central western New York district; Frank A. Denison, head of Gulf Coast district; Frank E. Davis, to manage new Mahoning Valley, Ohio, office; Henry A. Cirbee, manager of new Washington, D. C., office.

▸ *LARKIN COILS, INC.*—Wolfe-Evans Co., sales representative for Louisiana, Mississippi, Arkansas, parts of Texas including Houston and southern area.

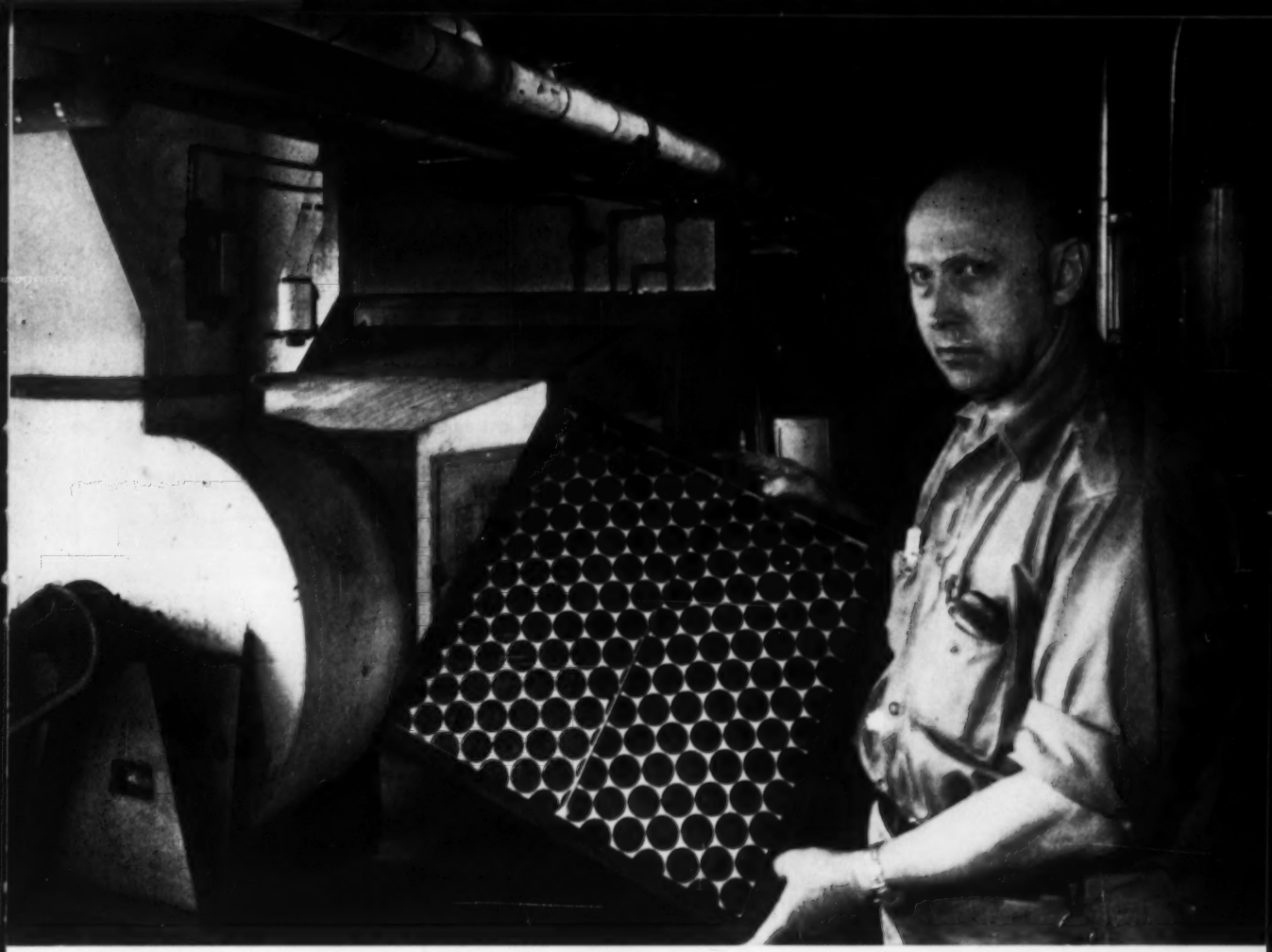
▸ *PHILIP CAREY MFG. CO.*—C. M. Brasher, assistant to general manager of southwestern division. Houston; D. L. Bigelow, merchandising manager of insulation products, Plymouth Meeting, Pa.; R. C. Bressan, manager of national accounts, New York City; C. L. Hoshaw, manager of insulation technical service and construction, Lockland, Cincinnati.

▸ *OLIN MATHIESON CHEMICAL CORP.*—Charles C. Barnett, Jr., regional sales manager of Western Brass Mills Div. His territory includes southern and western states, also Cincinnati and Indianapolis areas.

▸ *DEAN BROS. PUMPS, INC.*—Brown & Sites Co., Inc., foreign sales distributor.

▸ *VERSON ALLSTEEL PRESS CO.*—Donald Weiss, district sales manager, to service Ohio, Kentucky territories. He will maintain the company's newly formed direct sales office at Hamilton, Ohio.

WHO'S WHAT



This internationally-known research institute uses 1900 Glasfloss Fiber Glass Air Filters every three months to prevent dust build-up in electrostatic precipitators. Perfect atmosphere is needed to assure proper results in the many phases of research tests.

Glasfloss Air Filters help control atmosphere, lower air conditioning costs at world-famous research institute

More than 1900 Pittsburgh Glasfloss Air Filters are used every three months in the air conditioning system at this famous eastern research center to prevent dust build-up on electrostatic precipitators.

"Pittsburgh Glasfloss Filters help catch dust, prevent over-loading the electrostatic precipitators, lower maintenance costs through reduction of the number of times necessary for cleaning or flushing, and lessen the power load," reports the institute's director of engineering.

"Perfect air conditioning is a must at the institute, since we are devoted to long-range research of the effects of industrial techniques upon human welfare. We must control the atmosphere in order not to interfere with results of study on such subjects as air pollution, public health, sanitation and alleviation of industrial hazards. The fact that Pittsburgh Glasfloss Air Filters are constantly used in our air conditioning system speaks for itself."

GLASFLOSS FILTERS CAN GIVE YOU TOP SERVICE, TOO!

Pittsburgh Glasfloss Air Filters are made from fine, soft fiber glass which provides a greater, more efficient dust-collecting area, yet does not interrupt the flow of air. Glasfloss Filters are soft and easy to handle; this fiber glass does not splinter or pierce the skin.

Get top results from your heating and air conditioning systems with Glasfloss Filters. Try them once, and you'll buy them always! For the name of your local Glasfloss Distributor, call your nearest sales office, or write *Pittsburgh Plate Glass Company, Fiber Glass Division, One Gateway Center, Pittsburgh 22, Pennsylvania.*

PITTSBURGH GLASFLOSS FILTERS ARE A PRODUCT OF THE FIBER GLASS DIVISION OF PITTSBURGH PLATE GLASS COMPANY

Sales Offices are located in the following cities: Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Houston, Los Angeles, New York, Philadelphia and St. Louis

FIBER PG GLASS

PAINTS · GLASS · CHEMICALS · BRUSHES · PLASTICS

PITTSBURGH PLATE GLASS COMPANY

you take your pick

BUT you always WIN with

AURORA

CONDENSATION RETURN UNITS

EXAMPLE: APCO-MATIC

SIMPLEX TYPE HR and DUPLEX

AUTOMATIC
•
EFFICIENT
•
QUIET
•
DURABLE
•
DEPENDABLE

'Tisn't luck. It's certainty — when you entrust your condensation return jobs to an HR APCO-MATIC — or any — Aurora condensation return unit. The Type HR is suited to use where easy connection to low return lines is desirable. Available for use with heating systems with ratings from 800 to 10,000 EDR and pressures up to 80 P. S. I.

OTHER RETURN UNITS "by Aurora"

APCO HORIZONTAL UNITS with Cast Iron Tanks Simplex & Duplex up to 100,000 Sq. Ft. Rad. Cap. to 150 G. P. M.

•

APCO Packaged Square Tank UNITS for those Small, Low Pressure Jobs. 10 to 40 Lbs.

•

AURORA VERTICAL for BELOW FLOOR LEVEL RETURNS to 100,000 Sq. Ft. Rad. and 150 G. P. M.

•

WHATEVER YOUR RETURN PROBLEM AURORA CAN HANDLE IT

BRONZE PUMPING UNIT
Long life without corrosion.

•

RECTANGULAR RECEIVER
For maximum capacity in minimum space.

•

NO LEAKAGE
Mechanical Seal does it — keeps floor dry and clean.

•

MAINTENANCE
Is easy. Parts — or entire unit — replaceable without disturbing piping connections.

•

LOW RETURN OPENING
The large return opening of the 25 gallon receiver is only 16" from the floor.

•

LIFETIME RECEIVER
Of rust resistant cast iron with extra heavy walls.

Write TODAY for Bulletin 113-HR or Submit Your Problem to Our Engineers.

DISTRIBUTORS IN PRINCIPAL CITIES

AURORA PUMP DIVISION
THE NEW YORK AIR BRAKE COMPANY

80 LOUCKS STREET • AURORA • ILLINOIS

INTERNATIONAL SALES OFFICE, 90 WEST ST., NEW YORK 6, N. Y.

WHO'S WHAT

Continued

▸ *UNARCO AIR CONDITIONING PRODUCTS, NATIONAL-U.S. RADIATOR CORP.*—John T. Obrig, eastern regional sales manager.

▸ *FRICK CO.*—Alan J. Vandermade, in charge of newly opened branch office at Palo Alto, Calif.

▸ *HOFFMAN SPECIALTY MFG. CORP.*—Dick Cotton, sales representative for Minnesota, North Dakota, part of South Dakota, western Wisconsin.

▸ *DRAYER-HANSON, INC.*—Reallocated sales application engineers' territories are: William Keichline, areas surrounding Austin, Houston, Dallas, Boston, Denver, Kansas City, Little Rock, Wichita, New Orleans, San Diego; Irving Secord, El Paso, Minneapolis, Missoula, Mont., Miami, Salt Lake City, Omaha, Phoenix, Portland, San Francisco, Hawaii; Harvey Lange, original equipment manufacturer and commercial refrigeration accounts.

▸ *L.O.F GLASS FIBERS CO.*—James J. Secor, Jr., midwest regional sales manager with headquarters in Chicago; John A. Webb, Philadelphia district sales manager, succeeding Mr. Secor.

▸ *ATLAS VALVE CO.*—Warren Harriman, sales agent to cover southern New Jersey.

▸ *PACIFIC STEEL BOILER DIV., NATIONAL-U.S. RADIATOR CORP.*—R. B. Sweet & Assoc., representative for southern New Jersey, Delaware.

▸ *WORTHINGTON CORP.*—J. R. Matullo, branch manager of New Jersey sales office.

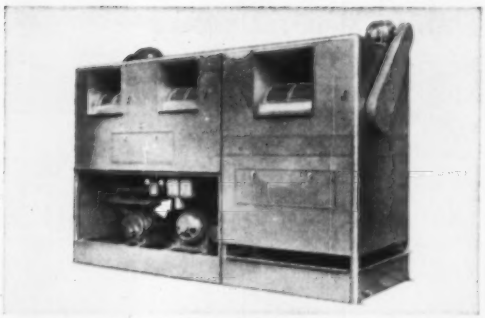
▸ *LANCASTER PUMP AND MFG. CO., INC.*—John McManus, direct factory salesman to serve distributors in Tennessee, Kentucky, West Virginia, Virginia; Harry Raskin, sales representative in Florida.

▸ *WAGNER ELECTRIC CORP.*—Russell E. Bryant, manager of electrical division of Los Angeles branch.

▸ *BALTIMORE AIRCOIL CO.*—Gene W. Hawitt, sales representative for the Carolinas.

▸ *CORY CORP.*—Richard H. Russell and Milton H. Otte, Jr., managers of company's New England and central south territories, respectively.

ALLEN-BRADLEY *Motor Controls and Accessories for Refrigeration and Air Conditioning*

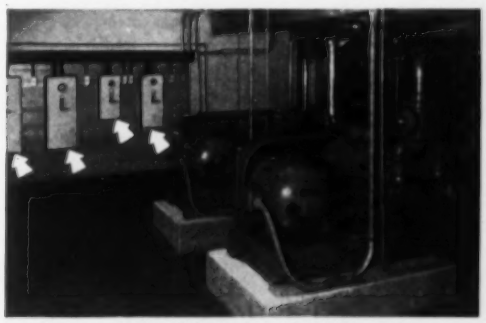


Bulletin 709 Across-the-Line Starters

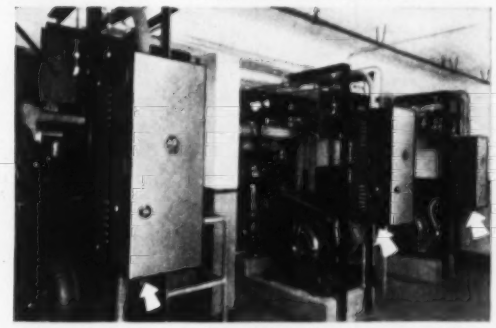
Bulletin 837 temperature control

Bulletin 836 pressure switch

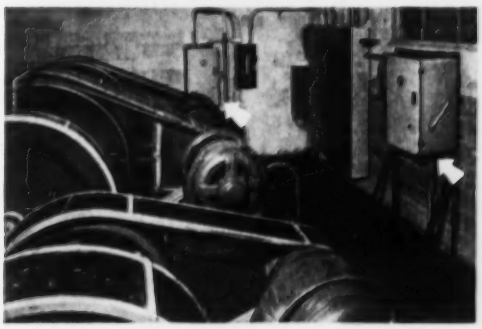
Bulletin 849 pneumatic timer



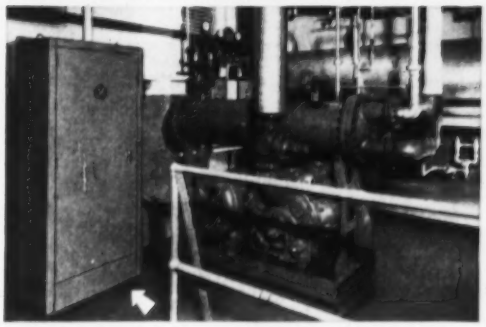
Bulletin 712 Combination Starters



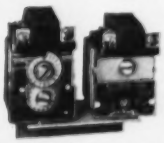
Bulletin 640 Manual Resistance Starters



Bulletin 646 Manual Autotransformer Starters

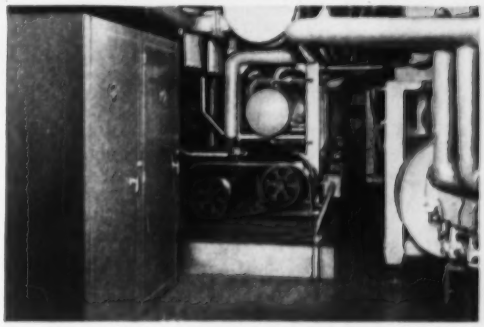


Bulletin 740 Automatic Resistance Starter



High and low pressure cutout

Bulletin 800 3-way selector switch



Bulletin 746 Automatic Autotransformer Starters

The Sign of Quality Motor Control

ALLEN-BRADLEY
SOLENOID MOTOR CONTROL
quality

Allen-Bradley motor starters have the simplest contact mechanism yet devised for air-conditioning or refrigeration installations . . . only ONE moving part . . . the solenoid plunger which carries the double break contacts.

There are no trouble-causing pins, bearings, or jumpers. The cadmium silver alloy contacts never need cleaning, dressing, or filing . . . eliminating costly and troublesome maintenance.

Allen-Bradley timers, pressure and temperature switches are reliably accurate . . . precision operation is maintained over long periods of service.

Specify Allen-Bradley—the name that stands for "Quality" motor control. You cannot make a better selection!

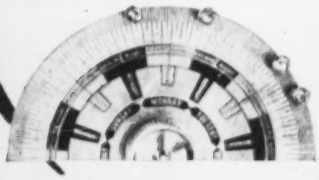
Allen-Bradley Co.
1335 S. First St., Milwaukee 4, Wis.
In Canada—
Allen-Bradley Canada Ltd., Galt, Ont.

Cut customer fuel bills 7 days a week

it's good business to always install a PARAGON 700 Series Calendar Time Switch on commercial heating units

YES, the good word gets around fast when a Paragon 700 Series Time Switch is on the job cutting heating bills. Heat is *automatically turned off* when not needed. Customer satisfaction through lower fuel bills *plus* fewer service "call backs" are big profit boosters for you! Check these features: :

- **COMPLETELY FLEXIBLE** — completely economical. Switch settings can be made for the entire week's schedule, yet easily and quickly changed. ON-OFF or OFF-ON operation can be as close as 3 hours.
- **FULLY AUTOMATIC** — set it, then forget it. Saves money weekends, for example: switch may be set to cut off heat Saturday noon, then automatically start regular heating cycle earlier than usual Monday.
- **INSTANTLY CHANGEABLE** — simply set the dial trippers at desired day or night hours. Total of 14 are supplied as standard equipment.



Ask for Bulletin HP-5407

See your jobber, or write: Dept. 1811

Dial is graduated in hours and half-hours. Night and day periods clearly separated. Available in 24, 120 and 240 volts; 25, 50 and 60 cycles. No complicated wiring. Lists as low as $28.50.

PARAGON ELECTRIC COMPANY

TWO RIVERS, WISCONSIN

World's Foremost Manufacturer of Time Controls

WHO'S WHAT

Continued

▸ *VIKING AIR PRODUCTS*—W. Benjamin Eckenhoff, eastern divisional sales manager. Appointed district sales managers within eastern division: Bernard Trautman, Philadelphia; Richard Belcher, Ipswich, Mass.; David J. Ahern, Long Island.

▸ *YORK-SHIPLEY, INC.*—Frank Holland, resident manager of new direct factory branch at Washington, D.C.

▸ *INLAND STEEL PRODUCTS CO.*—Richard W. Fisher, general sales representative for central Ohio.

▸ *CAPEWELL MFG. CO.*—Robert W. Hincks and James A. Maurseth, sales engineers for New England and southern California, respectively.

▸ *ELECTRONICS CORP. OF AMERICA*—Walter L. Brink, sales engineer to direct operations of new factory branch office at Pittsburgh. He will cover western Pennsylvania, West Virginia, part of Maryland.

▸ *TORRINGTON MFG. CO.*—Kenneth E. O'Shaughnessy, factory sales representative in New England, central New York State sales territories. He will represent the company's air impeller division.

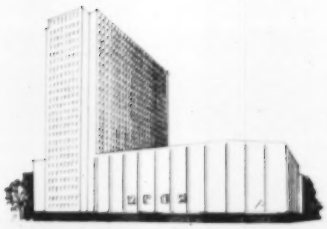
▸ *BLACK & DECKER MFG. CO.*—Barry R. Agenbroad, service manager of new Phoenix branch; Robert J. Burway, sales representative for that area.

▸ *HUCK MFG. CO.*—Daniel R. Bortner, sales engineer to cover Maryland, eastern Pennsylvania, southern New Jersey; Edward F. Walsh, a similar appointment for lower New York, Long Island, western New Jersey.

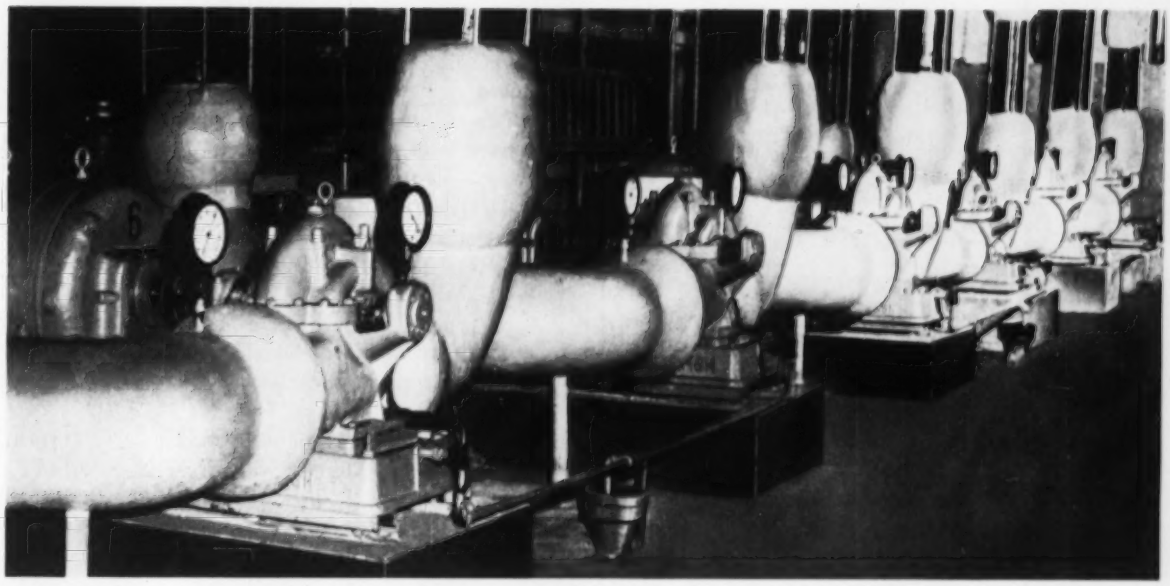
▸ *RUUD MFG. CO.*—Changes in staff of Pittsburgh district sales office are: Edward Dailey, commercial sales representative; Charles Gordon, transferred to that office from Cincinnati, to cover northwestern Pennsylvania.

▸ *RUSSELL, BURDSALL & WARD BOLT AND NUT CO.*—Russell E. Hoehl, assistant eastern sales manager; Alfred A. Binkerd, district sales manager of Philadelphia territory, succeeding Mr. Hoehl.

▸ *BRISTOL CO.*—S. E. Gewin, district manager of Chicago office; Walter Messner, manager of St. Louis office, succeeding Mr. Gewin. ∓



Visit us at the Power Show in New York's new Coliseum where...



13 AMERICAN-MARSH PUMPS circulate up to 31,650 g.p.m. of water for air conditioning service

A lot of water? Yes, the cooling requirements are enormous in this busy "showplace of the nation!" The result is a pumping installation any engineer-contractor team could specify and install with pride and confidence.

Altogether, thirteen American-Marsh Type HLM and HIM Pumps were selected for outstanding dependability and efficiency. Installed in the Coliseum for this high static head system are:

CHILLED WATER PUMPS—*Two* Type HIM, Size 6", Capacity 1650 GPM each. *One* Type HIM, Size 5", Capacity 1200 GPM. *Three* Type HLM, Size 8", Capacity 2500 GPM each.

COOLING TOWER PUMPS—*Three* Type HLM, Size 12", Capacity 5750 GPM each. *Two* Type HLM, Size 8", Capacity 2400 GPM each.

BOOSTER PUMPS—*Two* Type HIM, Size 6", Capacity 1800 GPM each.

All are horizontal split case type centrifugal pumps, specifically fitted for the job. Each individual pump was fully tested and proved to meet or exceed all specifications before shipment.

This standard-practice thoroughness and attention to quality means that *you* can specify American-Marsh Pumps with full confidence! Write today for data—or call your nearby A-M Representative.

OWNER—Triborough Bridge & Tunnel Authority
ARCHITECT—Leon and Lionel Levy
MECHANICAL ENGINEER—Guy B. Panero
STRUCTURAL ENGINEER—Dr. Jacob Feld
GENERAL CONTRACTOR—Walsh-Fuller-Slattery
HEATING, VENTILATING AND AIR CONDITIONING CONTRACTOR—Almirall & Co., Inc.

WRITE TODAY for Bulletin 350 describing HLM-HIM PUMPS
(The types installed in the Coliseum)

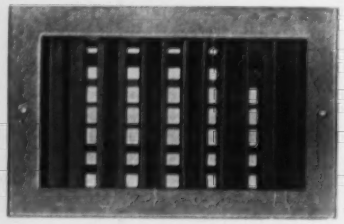
AMERICAN-MARSH PUMPS
BATTLE CREEK MICHIGAN
Pumps and Pumps only Since 1873

In Canada: American-Marsh Pumps (Canada) Ltd., Stratford, Ont.

CENTRIFUGAL, TURBINE, STEAM AND POWER PUMPS FOR TESTING, PROCESSING, BOILER FEED, FIRE PROTECTION, ETC

THE SIGN OF QUALITY and SERVICE — *Since 1902*

Waterloo AIR DIFFUSION EQUIPMENT

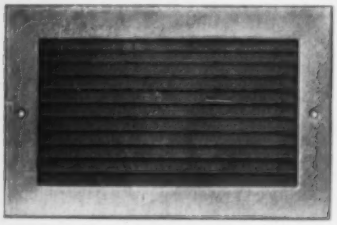


2VO SUPPLY REGISTER

Two sets of adjustable louvres, vertical and horizontal, with opposed blade damper, vertical blade for even volume control. Fins spaced on ¾" centers. Provides positive air control.

3H RETURN AIR GRILLE

Fixed fins at 45 degree or 0 degree deflection, in heavy gauge frame, strengthened with adequately spaced support bars.



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Write for Complete New Catalog— or Name of Your Local Representative

WATERLOO REGISTER CO., INC.

P. O. Box 72 **Waterloo, Iowa**

WE HEAR THAT . . .

▸ *BENDIX-WESTINGHOUSE AUTOMOTIVE AIR BRAKE CO.* has arranged to purchase *SERVEL, INC.'s* assets and facilities for the manufacture of refrigeration compressors. These facilities will be operated by Bendix-Westinghouse in two former Servel buildings at Evansville, Ind., for the production of ¼ to 7½ hp electric motor-compressors for use by air conditioning and refrigeration manufacturers. Included in the purchase are 12.27 acres of land and buildings, machinery and equipment, inventories, patents, trade marks and technical information.

▸ All rights to manufacture and distribute humidifiers manufactured by *DAFFIN MFG. CO.* have been sold by Daffin and *LANCASTER ENGINEERING CORP.* to *HERMIDIFIER CO.* The transaction includes all inventories of completed units and spare parts as well as manufacturing tools and materials. *PAUL A. HERR* is president of the newly formed company.

▸ The Consulting Engineers Association of Oregon has been recently formed with *JOHN BONEBRAKE, RAYMOND CHEWNING, JAMES HOEY, DONALD KROEKER, ROBERT MARQUESS, BRUCE MORRISON* and *THOMAS TAYLOR* as members.

▸ *FLODAR CORP.* has relocated to 16911 St. Clair Ave., Cleveland.

▸ *WALWORTH CO.* has contracted to acquire all the outstanding capital stock of *GROVE VALVE AND REGULATOR CO.* and *GROVE CONTROLS, INC.*

▸ Ground was broken recently for a two-classroom school building intended to make the traditional stuffy, sleep-inspiring classroom a thing of the past. To be built in Des Moines, Iowa, and financed by *LENNOX INDUSTRIES, INC.* as a research project, the completed school will be turned over to the public school system to house regular classes about the first of the year. A new heating and ventilating system, which is to be used in the structure, is designed to supply outside air throughout the room during all seasons of the year.

▸ *R C S TOOL CORP.* has moved to 227-229 E. Front St., Bloomington, Ill.

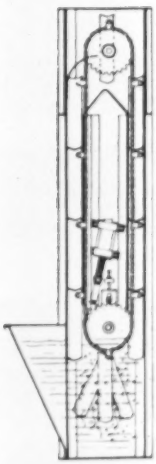
▸ *ALL-STATE WELDING ALLOYS CO., INC.* has completed the fifth expansion within 10 years of its White Plains, N.Y., center for research, development and manufacture. Although it is estimated that the 1956 building program has added a third to All-State's capacity, need for more manufacturing space is immediate, the company reports.

Random Thoughts from a Filter Engineer

by Bruce Carkin, Sales Engineering Department

- **AUTOMATION...IT EVEN FILTERS AIR**
- **LOOK OUT...PRICE TAGS ARE DECEIVING**
- **SUPPOSE AIR COST MONEY?**

AUTOMATION— IT EVEN FILTERS AIR



With the big swing to automation, most everybody looks for push-button equipment that runs itself. You might say our Automaze does just this when it comes to filtering air. Here's what we mean.

With Automaze, all you need to do is start it up. Then you can forget your problem of filtering air. To assure maximum effective filtration, there's a *double* curtain of impingement-type filter panels through which the air must pass.

Another nice thing about Automaze is that it *maintains* its peak efficiency. That's because the adhesive is applied *on a continuous cycle*, unlike the stationary panel-type filter.

Automaze is also completely self-cleaning. All the panels are automatically dipped and agitated with a highly effective "pulse" action in a bath during cleaning and renewing of the adhesive. Maintenance is simple. Once or twice a year a reservoir is drained and cleaned.

Speaking of automation, our Electromaze (electronic air filter) also removes dust particles automatically if extremely fine dust is your problem.

LOOK OUT...PRICE TAGS ARE DECEIVING

Be careful you don't judge a filter by its price tag. Look at the overall cost (that includes operation and maintenance) before you buy. Remember, *all* filters must be serviced regularly—whether they're panel type or electrostatic. And we at Air-Maze make both.

As a case in point, take the Electromaze—our electronic air filter that removes dirt particles down to 1/50 of a micron. The first cost may seem high, but look at the savings in service costs over panel-type filters.

It costs about 60 cents to clean and renew the adhesive on one impingement type panel. This adds up to an $18 bill just to clean a 24,000 cfm job. Consider that you service these panels once a month, you're out $216 a year . . . many times the cost of operating and servicing the Electromaze.

Before you decide on any filter, you'll be money ahead by calling in a consulting engineer—or writing us at Air-Maze.

SUPPOSE AIR COST MONEY?

If we had to pay for air, chances are people would be a whole lot more particular about it. Generally speaking, though, most folks consider the air around us as being "clean". You and I in the air filtration business, of course, know that nothing could be farther from the truth.

As luck would have it the human eye is a notoriously poor judge of cleanliness. Experts tell us the eye can only detect air-borne dirt particles 10 microns and larger. Actually, the air around us is teeming with dirt particles smaller than 10 microns.

But man's inability to see air-borne dirt points up why many a person is led to believe that *any* filter will solve almost *any* air filtration job. Those of us in the business know by experience that every filter must be engineered with extreme care to fit specific requirements—high dirt holding capacity, low pressure drop, air velocity, cost.

This problem of engineering each filter to meet specific needs is one that Air-Maze has been working with since 1925. Regardless of what requirements your installation calls for, we have the right filter to do the job. Why not write us? The Air-Maze Corporation, Cleveland 28, Ohio.

AFI MEMBER

AIR-MAZE

The Filter Engineers

AIR FILTERS • SILENCERS • SPARK ARRESTERS
LIQUID FILTERS • OIL SEPARATORS • GREASE FILTERS

A NEW more reliable air conditioning method

with exact moisture control FOR YOUR PROCESS OR PROTECTION FOR TESTING PRODUCTS OR MATERIALS AT ANY TIME OF THE YEAR

Assembling Electronic Parts

Packaging Food Products

Drying Industrial Material

● This Niagara "Controlled Humidity" method gives you the **MOST EFFECTIVE** Air Conditioning because its cooling and heating functions are made completely separate from adding or taking away moisture. This assures you always a precise result. No moisture sensitive instruments are needed.

MOST FLEXIBLE. You can reach and hold any condition in response to instrument settings, or vary it as you wish.

EASIEST TO TAKE CARE OF. The machine is accessible, the control circuits are simple and easy to operate, and there are no solids, salts or solutions to be handled.

MOST COMPACT. It does a very large amount of work in a small space.

INEXPENSIVE TO OPERATE. At normal atmospheric temperatures (unlike systems that use refrigeration to dehumidify) it needs no summer re-heat.

Write for Bulletins 112 and 122

NIAGARA BLOWER COMPANY

Dept. HP, 405 Lexington Ave. New York 17, N. Y.

Niagara District Engineers in Principal Cities of U. S. and Canada

WE HEAR THAT

Continued

▸ Special air conditioning meetings were held by *TRANE CO.* in 44 cities across the nation, beginning July 30 in Cleveland and concluding October 29 in St. Paul and Wichita. Designed specifically for engineers, architects and special guests, the programs included exhibits, slide presentations and discussions. The meetings concentrated primarily on the application of new air conditioning products.

▸ "People who live in glass houses shouldn't throw . . . ." is an age-old truism that was completely ignored by *BRYANT DIV., CARRIER CORP.* when it dedicated its new branch sales and distributing building in Detroit recently. The entire roof of the structure, located in suburban Madison Heights, is made of "Fiberglas Perma-Ply." Bryant did, however, see fit to "throw" two open houses in opening the new facility.

▸ *AUTOMATIC SWITCH CO.* has moved its Pacific Coast factory branch to larger quarters in East Los Angeles. The facility is located at 1233 Goodrich Blvd.

▸ "Websterama Products Parade," a presentation of new developments in heating and cooling equipment manufactured by *WARREN WEBSTER & CO.*, is now on tour of 50 principal cities. Launched in Philadelphia in September, the presentation is planned for architects, engineers, heating contractors, and building owners and managers. The itinerary includes cities in 37 states this fall and winter.

▸ Dedication ceremonies at the enlarged *JOSEPH T. RYERSON & SON, INC.* steel service plant at Jersey City were attended by some 3000 of the firm's customers and other business and civic leaders. The plant now has approximately 355,000 sq ft of space devoted to warehousing, processing and shipping.

▸ A production milestone was recorded by *TRANE CO.* recently when its 3 millionth convector rolled off the lines. Trane utilizes its Scranton, Pa., facilities to produce convectors in 21 models.

▸ *NATIONAL-U.S. RADIATOR CORP.* has moved its Washington, D.C., branch sales office and warehouse to 6310 Chillum Pl., N.W. The facility contains about 4000 sq ft of floor space.

▸ Construction of a new $200,000 office building has been started by *BORG-WARNER CORP.'s* Calumet Steel Div. in Chicago Heights, Ill. The structure,

See for Yourself

...What's new and what's ahead at the

13th INTERNATIONAL HEATING & AIR-CONDITIONING EXPOSITION

(formerly the International Heating & Ventilating Exposition)

INTERNATIONAL AMPHITHEATRE—CHICAGO

FEBRUARY 25—MARCH 1, 1957

Under the auspices of the American Society of Heating and Air-Conditioning Engineers, and in conjunction with their 63rd annual meeting.

PLAN FOR THE FUTURE—come to Chicago! New ideas and new developments—the latest advances in all phases of heating, ventilating and air conditioning will be on view to you for full five days. At the largest exposition of its type in the world, you will get the latest *first-hand* information from more than 450 exhibitors and their technical representatives. It's information that means personal profit to you, whatever your special interests—industrial, commercial or domestic installation—they will all be on show at Chicago!

Write today for advance registration to:

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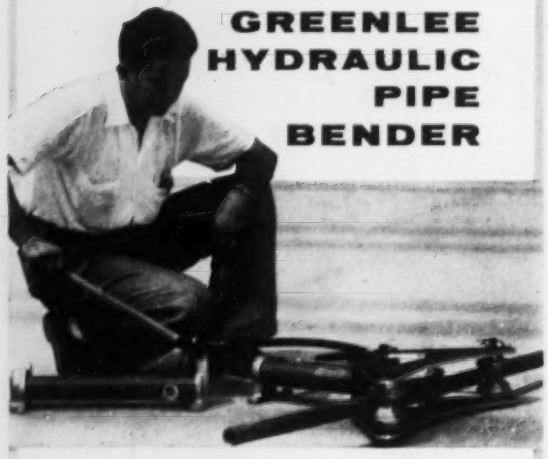
save time, cut costs on your piping installations with lightweight, portable

GREENLEE HYDRAULIC PIPE BENDER



easy, fast operation makes 90° bend with one ram stroke

Quickly produce your own bends in cold pipe *right on the job* . . . exactly the way you want them, to make a correct-working, neat-fitting installation. Save hours of time, save labor, eliminate cost of many manufactured bends and fittings with the GREENLEE No. 880 Hydraulic Bender for 1½" to 2" pipe. Easily carried and operated by *one man*. Accurate . . . makes bends to just the angle required. Fast . . . *a complete 90° bend made with one ram stroke*. Radius attachment also available for making radiant heating 180° return bends in tubing and pipe. Powerful . . . 15 tons of ram force! Easily operated by hand, or may be teamed with a GREENLEE power pump for production-line bending either in your shop or out on the job. GREENLEE line also includes larger hydraulic benders for pipe up to 5" and hand benders for tubing and small pipe. Get the complete story on how you can speed your work, make better installations, and cut job costs with a GREENLEE Bender. Write for folder E-221.

TOOLS FOR CRAFTSMEN

GREENLEE

GREENLEE TOOL CO.

2351 12th Street, Rockford, Illinois

WE HEAR THAT

Continued

scheduled for occupancy next March, will be completely air conditioned and will include the latest in heating and lighting equipment.

▸ *FRICK CO.'s* Philadelphia branch office has been moved to 408 Wilford Bldg., 33rd and Arch Sts., in that city.

▸ A new post-graduate level engineering education program has been announced by *CARRIER CORP.* The plan will make it possible for many engineers employed by Carrier to obtain advanced degrees in mechanical engineering on a part-time basis without cost.

▸ *RAWLPLUG CO.* is building a new garden type factory at New Rochelle, N. Y. The plant is to house new semi-automatic die casting machines, streamlined production methods for the manufacture of "Rawlplugs" and other products, and the general offices of the company.

▸ *DELCO APPLIANCE DIV., GENERAL MOTORS CORP.* inaugurates its 1956-57 factory training schedule early this month. Factory service training schools will cover many phases of service training, the company reports. The school is open to personnel from all franchised "Delco-Heat" dealers.

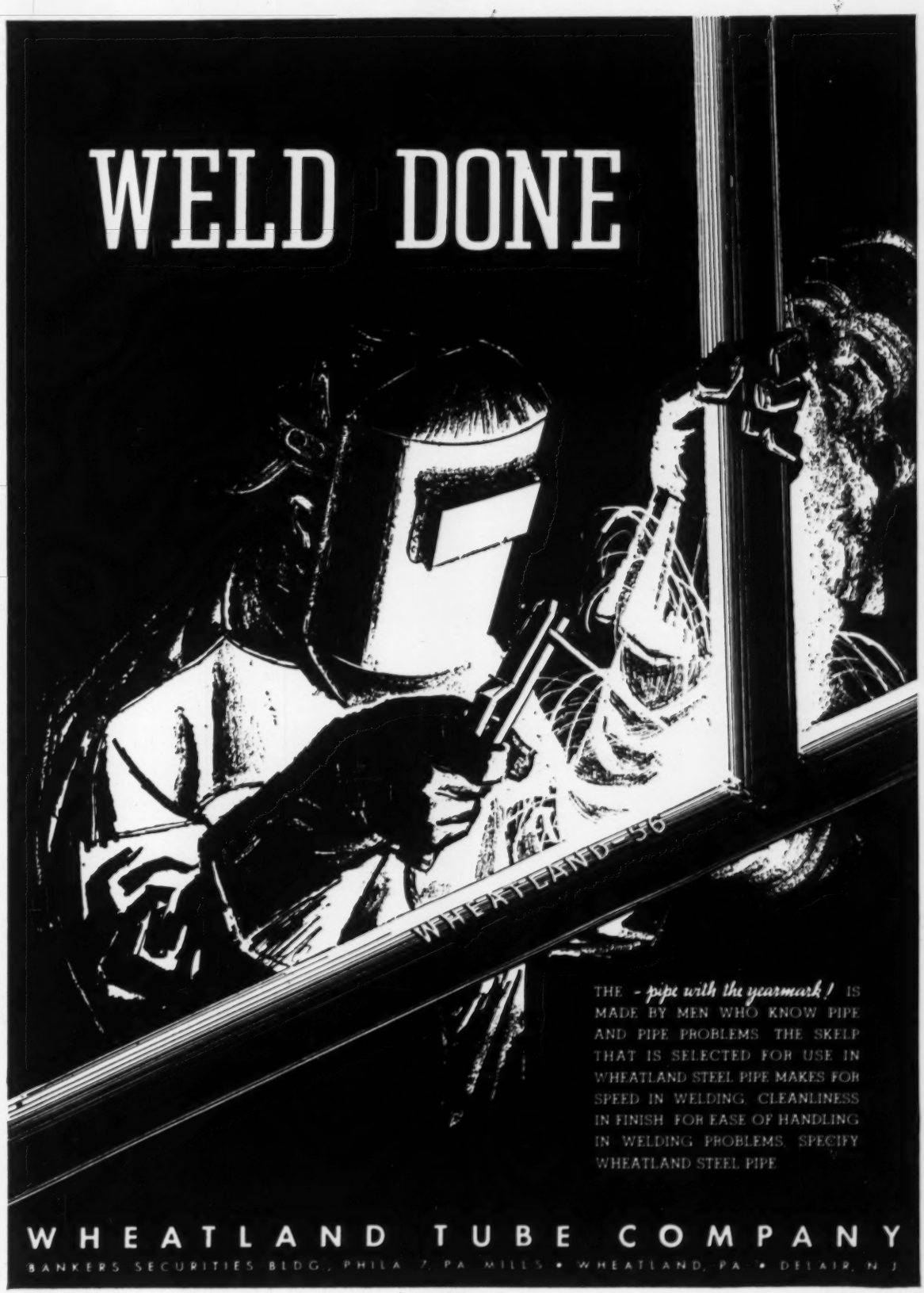
▸ Some 275 Frigidaire dealers in the Detroit area attended the dedication of *FRIGIDAIRE DIV., GENERAL MOTORS CORP.'s* new service training school which opened recently at GM's modern training center, there.

▸ Educational grants totaling approximately $1 million by *INTERNATIONAL NICKEL CO., INC.* in its program for aid to higher education, have been reported by the company. Some $400,000 of these grants will be for the current 1956-57 academic year with about 85 universities and colleges sharing the grants. The remaining $600,000 will be applied to extending fellowships and scholarships during the following four years.

▸ *METALS & CONTROLS CORP.* has moved its New York sales office to larger quarters at 1 E. 42nd St. The office will serve both the Spencer Thermostat and General Plate Divs. of the corporation.

▸ *ALLSTEEL PRESS CO.* has formally opened new offices at its 93rd St. and Kenwood location in Chicago. Its new, fully air conditioned facilities are a 6000 sq ft addition to existing offices.

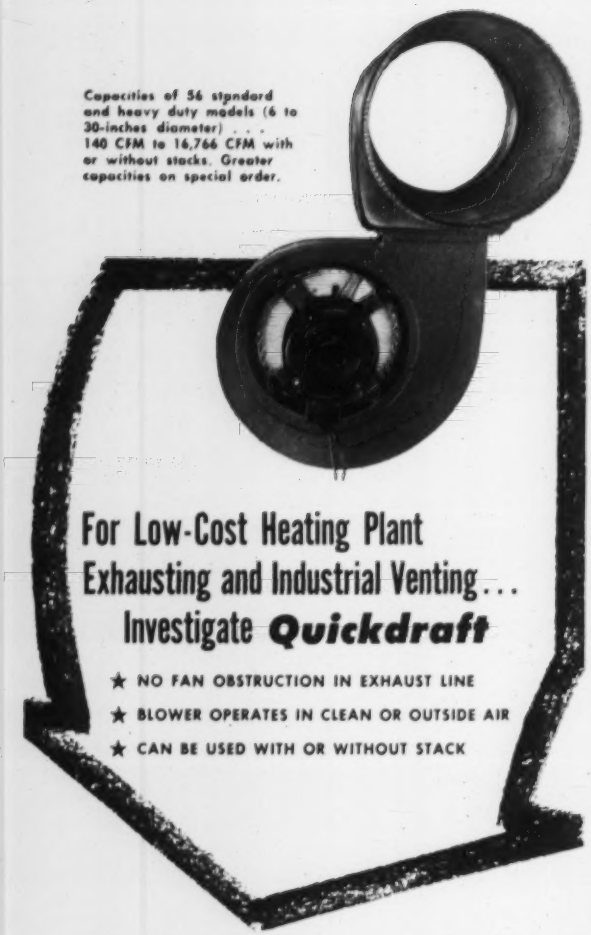
WELD DONE



THE - *pipe with the yearmark!* IS MADE BY MEN WHO KNOW PIPE AND PIPE PROBLEMS. THE SKELP THAT IS SELECTED FOR USE IN WHEATLAND STEEL PIPE MAKES FOR SPEED IN WELDING, CLEANLINESS IN FINISH, FOR EASE OF HANDLING IN WELDING PROBLEMS. SPECIFY WHEATLAND STEEL PIPE.

WHEATLAND TUBE COMPANY

BANKERS SECURITIES BLDG., PHILA. 7, PA. MILLS • WHEATLAND, PA. • DELAIR, N. J.

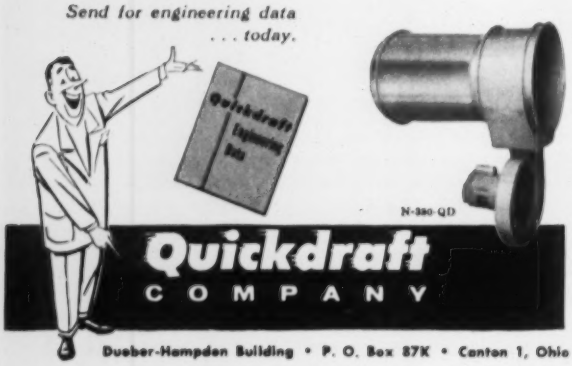

Capacities of 56 standard and heavy duty models (6 to 30-inches diameter) . . . 140 CFM to 16,766 CFM with or without stacks. Greater capacities on special order.
For Low-Cost Heating Plant Exhausting and Industrial Venting . . . Investigate Quickdraft
★ NO FAN OBSTRUCTION IN EXHAUST LINE
★ BLOWER OPERATES IN CLEAN OR OUTSIDE AIR
★ CAN BE USED WITH OR WITHOUT STACK

FOR HEATING PLANTS AND INCINERATORS. Quickdraft provides constant draft required for efficient and economical combustion. It prevents noxious concentrations of deadly fumes and dangerous accumulations of explosive gasses from escaping into buildings. It eliminates pulsating or chattering, puffing, smoking and sooting.

FOR INDUSTRIAL VENTING. Quickdraft eliminates down-time for cleaning and replacing fan blades . . . cuts maintenance costs. It is ideal for venting paint booths . . . abrasives, corrosive gasses, noxious fumes, high temperatures and moisture.

FOR MOVING AIR . . . in or out of buildings through ducts . . . Quickdraft is outstanding.

Send for engineering data . . . today.



WE HEAR THAT

Continued

▸ For the fourth consecutive year an opportunity to secure a college education has been made possible for selected high school graduates who reside in communities where *NATIONAL-U.S. RADIATOR CORP.* has manufacturing plants. The three recipients of 1956 scholarship awards are attending Lehigh and Penn State Universities and Carnegie Institute of Technology.

▸ Twenty-two graduate engineers representing 14 states and Canada have enrolled in the six month specialized training program of *TRANE CO.* Purpose of the "post-graduate" course is to equip the students with the practical engineering skill necessary for the industry before being assigned field responsibilities.

▸ The *REFRIGERATION ENGINEERING, INC.* "museum of air conditioning and refrigeration equipment" was previewed for the first time on television recently, when *H. T. JARVIS*, president of the company, was featured on a network program showing antique equipment from the museum, which Mr. Jarvis founded.

▸ For the third consecutive year *CARRIER CORP.* has won the bronze "Oscar of Industry" for the best annual report in the air conditioning and refrigeration industry, awarded by *Financial World* magazine. In the 1956 competition *WORTHINGTON CORP.* placed second and *TRANE CO.*, third.

▸ *MARCO INDUSTRIES, INC.* celebrated its 10th anniversary recently by turning out its 6 millionth small electric motor.

▸ Four field training supervisors of *AIRTEMP DIV., CHRYSLER CORP.* have completed their first annual refresher course at the company's Dayton factory. The supervisors have begun a series of conferences to be held throughout the country with Airtemp regional representatives, distributors and dealers.

▸ To aid victims of Hurricane Flossy in Louisiana, Georgia, Alabama, Florida and North Carolina, *AMANA REFRIGERATION, INC.* has offered to repair and place in good operating condition any of its air conditioners that were damaged by the storm.

▸ Four-year scholarships to the University of Tennessee valued at $4300 per year are being offered to three outstanding high school graduates by *FULTON SYLPHON DIV., ROBERTSHAW-FULTON CONTROLS CO.*

☆ ☆ ☆

Manufacturers' Agents

Are you interested in securing additional lines?

We are occasionally asked by our manufacturer advertisers to suggest the names of manufacturers' agents in various sections of the country whom they can contact in regard to representation of their industrial and large building heating, piping, and air conditioning products.

If you would like your name listed on our records for inquiries we may receive on your territory, we invite you to write us. There is no charge in connection with this service.

Heating, Piping & Air Conditioning

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put *Extra-Profits* in your pocket with

ELGEN *All-Tite* VANE RUNNERS NOW IN COILS!

VANE RUNNERS
THE EASIEST AND QUICKEST WAY EVER DEVISED
for installing single or double blade turning vanes in square elbows. No special tools required.

New production machinery of our own exclusive design, now enables us to produce button type Elgen All-Tite vane runners in continuous coils, effecting a savings in *your cost per job.*

COILED ELGEN ALL-TITE VANE RUNNERS MEANS . . .

- *Less Waste!* Waste pieces due to short ends are a thing of the past. Vane runner metal is coiled in 100 foot lengths, you just pull out the exact footage needed.
- *Easier Storage!* Each coil weighs approximately 50 lbs. and is packed in a box 28" x 28" x 5". Box fits easily under bench or against wall.
- *Easier Handling!* No loose pieces lying around to get in the way or collect dirt.
- *Unrolls absolutely flat!* Vane runner metal emerges from the box at bench height . . . absolutely flat . . . ready for use.

TWO MORE ENGINEER-APPROVED ELGEN PRODUCTS THAT SAVE YOU TIME AND MONEY

ELGEN SILENT DUCT

. . . for forming "flexible" duct connectors. A one piece metal to material unit, packed in coils, unrolls absolutely flat. Makes on the spot work a cinch.

ELGEN DAMPERSET

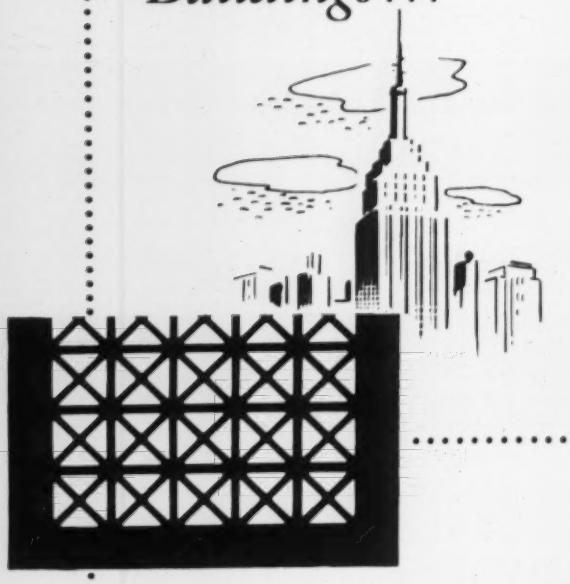
. . . for multi-blade dampers, parallel or opposed. Most perfect damper hardware developed.

ELGEN PRODUCTS ARE SOLD THROUGH LEADING JOBBERS EVERYWHERE.

Write today for free catalog and "spec" sheet!

ELGEN MANUFACTURING CORP.
41-34 39th Street, Long Island City 4, N. Y.

For Beauty In Buildings . . .



What makes one building interior stand out over others? In many cases it's that extra touch of splendor given by Hendrick Grilles. There are over one hundred different Hendrick Grilles available to harmonize with the most modern designs for residential, business or public buildings . . . many are exclusive Hendrick designs. Each design can be furnished in a wide range of overall dimensions, bar sizes and number of perforations. And they're easy to install because they always lay flat . . . don't bend or warp. Write for complete details.

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Sales Offices in Principal Cities

Perforated Metal • Perforated Metal Screens • Wedge-Slot and Hendrick Wedge Wire Screens • Architectural Grilles • Mitco Open Steel Flooring • Shur-Site Treads • Armorgrids • Hendrick Hydro-Dehazer

WE HEAR THAT

Continued

▸ Preceding the September meeting of the Connecticut Valley section of the American Society of Refrigerating Engineers, members and guests visited the West Hartford plant of *DUNHAM-BUSH, INC.*

▸ Many hundreds of years of practical experience in marketing heating and air conditioning equipment worked to the benefit of *NATIONAL-U.S. RADIATOR CORP.* when its branch managers reviewed the past and made plans for the future during a recent home office gathering in Johnstown, Pa.

▸ *TRANE CO.* has earned an "excellent management" rating in a continent-wide analysis conducted by American Institute of Management. Basis for the rating is a continuous comparative analysis which AIM conducts of companies.

▸ Announcements of product improvement, better packaging and new production schedules highlighted a two-day quarterly sales meeting of the blower division of *LAU BLOWER CO.* ⊣

NOW is the time to consider

SNOW MELTING

Systems around Buildings and Grounds

Better send at once for our SNOW MELTING MANUAL. Here are design data based on a study of—and others' actual experience with over 100 snow melting systems of all kinds for

- **LOADING PLATFORMS and DOCKS**
- **SIDEWALKS • ROADS • DRIVEWAYS**
- **MARQUEES • PARKING AREAS**
- **RUNWAYS • RAILWAY SWITCHES**

and other applications which HAVE proved that this modern method of snow removal

Costs No More Than Other Methods

—and because snow melting by pipe coils has other distinct advantages, such as dirt-free sidewalks and entrances, and the complete elimination of ice surfaces, the demand for this method of snow removal is swiftly growing.

Complete information on the correct design, installation and operation of snow melting systems is offered in the new SNOW MELTING MANUAL, a reprint of articles originally published in HEATING, PIPING & AIR CONDITIONING.

Fifty cents will bring you this SNOW MELTING MANUAL . . . a valuable addition to your file on business opportunities.

Heating, Piping & Air Conditioning

6 North Michigan Avenue **Chicago 2, Illinois**

designed to

Industry

requirements

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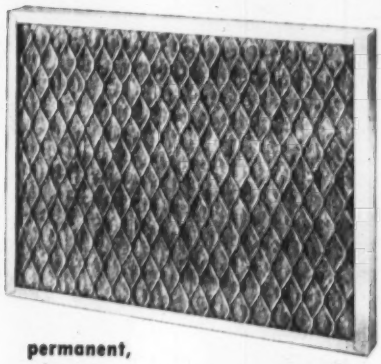

permanent,
dry-type

copper

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AIR FILTER

engineered to industry specifications for all corrosive atmospheres

Here's the filter that solves the problem of air-cleaning in installations involving corrosive fumes, dusts or vapors. Pure COPPER wool media catches and holds *all* the dirt – and the media does *ALL* the filtering. No oils or adhesives required. Never rusts or corrodes. No fire hazard. Saves time; saves money!

All-metal *lifetime* construction with copper-plated mat retainers and aluminized steel frames for added strength and lightweight. Washes in a jiffy in water or solvents for immediate re-use. Outlasts ordinary filters as much as 10 to 1 – eliminates replacement costs; cuts maintenance expense. Approved by Underwriters' Laboratories.

standard and *'HIGH-VELOCITY'* types for every air-cleaning application

Available in ½", 1" and 2" sizes for any filter installation. *A-LUM-O-AIRE* Filters can be engineered to exact specifications for special applications. Also furnished with *aluminum-wool* media for non-corrosive recirculated air applications.

world's largest manufacturers aluminum and copper wool

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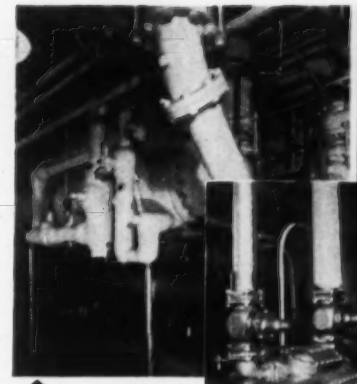
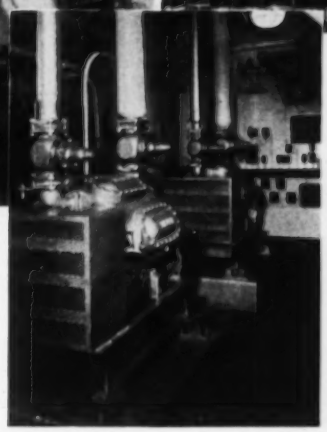
1880 Clifton Avenue Springfield, Ohio



Part of the Vilter air conditioning equipment at Southwestern Bell Freon heat exchanger, 5-pass Freon water chiller, 2-pass Freon condenser, and Freon liquid receiver.

Office building, Southwestern Bell Telephone Company, St. Joseph, Missouri.



Two Vilter Freon 12-VMC compressors, complete with oil separators.

Q. How can the summer efficiency of many operators be increased in a busy telephone exchange?

A with efficient Vilter AIR CONDITIONING

that costs less to own*

Busy workers throw off a great deal of heat—even though many are seated at long switchboards. Warm, "sticky" atmosphere means short tempers and reduced efficiency. BUT dependable air conditioning with proper humidity control, filtering and ample fresh air will rapidly change this. And the best solution of all is to install a Vilter system to assure efficient, economical results at a reasonable cost.

The Vilter equipment included in this telephone company installation consists of two 8-cylinder Freon 12-VMC compressors, a 2-pass Freon condenser, liquid receiver, water cooler and heat exchanger. The VMC's are designed for smooth operation, efficient performance and a minimum of vibration to reduce the noise level . . . a real asset in an office building.

A high point of the application is the attractiveness of this installation. Vilter, while primarily interested in utility, also exerts every effort to include eye-appeal in the design and installation of equipment.

See your nearest Vilter engineer, today, for a careful evaluation of your air conditioning and refrigeration needs.

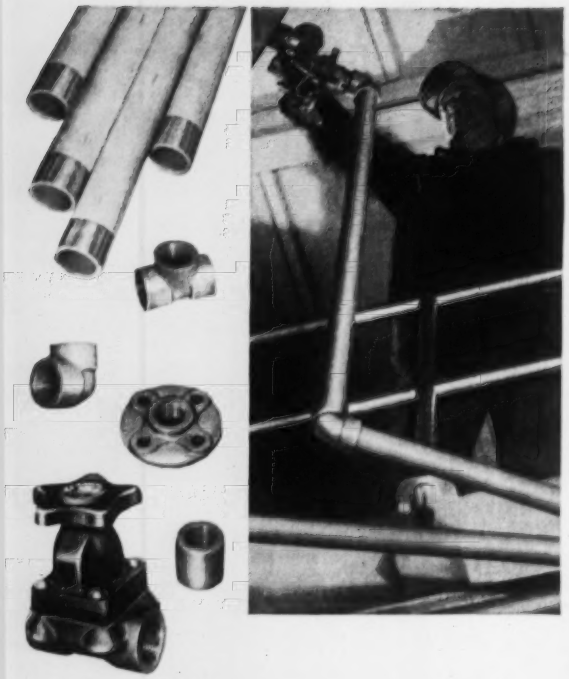
* Savings in low first cost are not the complete answer when considering the installation of refrigeration equipment. But savings in terms of years of extra service, reliable performance and minimum maintenance—that's where Vilter excels in low-cost ownership.

Vilter QUALITY CRAFTSMANSHIP that lasts . . .
ENGINEERING DESIGN that guarantees performance

REFRIGERATION and AIR CONDITIONING

THE VILTER MANUFACTURING COMPANY, Milwaukee 7, Wisconsin

Air Units • Ammonia & Freon Compressors • Booster Compressors • Baudelot Coolers • Water & Brine Coolers • Blast Freezers • Evaporative & Shell & Tube Condensers • Pipe Coils • Valves & Fittings • Pakice & Polarflake Ice Machines



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Van-Cor

PIPING

An Ohio plant was faced with high pipe maintenance costs because the acetic acid produced is strong enough to eat holes in steel. Instead they installed Van-Cor plastic piping that is still good as new after 18 months' service.

Van-Cor pipe, fittings and valves have solved similar problems with scores of corrosive chemicals. An unplasticized polyvinyl chloride, Van-Cor weighs less, and is easier to install, than conventional piping. It serves longer, thus costs far less . . . Van-Cor sheets are also fabricated into ducts, hoods, tanks, fumestacks, etc.

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SUBSIDIARY OF THE VAN DORN IRON WORKS CO.
2685 EAST 79th STREET • CLEVELAND 4, OHIO

MEETINGS & CONVENTIONS

1956

NOV. 8-9—National Association of Corrosion Engineers, southeast regional meeting. Charlotte, N. C. NACE headquarters: 1061 M & M Bldg., Houston 2.

NOV. 14-15—Industrial Hygiene Foundation, 21st annual meeting. Mellon Institute, 4400 Fifth Ave., Pittsburgh 13.

NOV. 14-16—Air Conditioning Institute. Dept. of Engineering, University of Wisconsin. Information: Ralph D. Smith, coordinator, Extension Div., University of Wisconsin, Madison 6.

NOV. 15-16—National Association of Corrosion Engineers, fall meeting of western region. Lafayette Hotel, Long Beach, Calif. NACE headquarters: 1061 M & M Bldg., Houston 2.

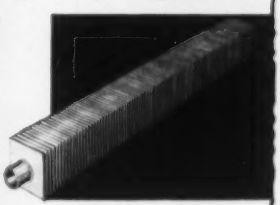
NOV. 15-16—Conference on Windows and Glass in the Exterior of Buildings. U.S. Department of Commerce, Washington, D.C. Conducted by Building Research Institute, 2101 Constitution Ave., Washington 25, D.C.

You Name It . . .

There's a G&O Finned Tube For Every Heating & Cooling Need

Users Have Named

G&O "The Finest"



When quality in heating or cooling products is uppermost, the brand of finned tube that's uppermost in manufacturers' minds is G & O . . . famous for quality, excellence of design and construction, experience in engineering applications, fine workmanship and superior heating-cooling efficiency since 1915.

To improve your heating-cooling product of the future, write today for G & O literature on Finned Tubing in • straight lengths, U-bends, continuous return-bend coils, and special shapes for use in • heating coils, • unit heaters, • blast coils, • intercoolers, • after-coolers, • baseboard radiation, and • convector elements.

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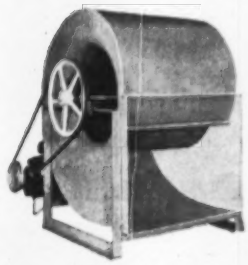
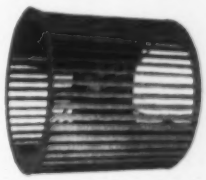
BARRY blower wheels are precision made from either steel, stainless steel, copper, brass or aluminum, and are expertly balanced and trued. Many of the country's leading heating, air conditioning and ventilating equipment manufacturers use BARRY blowers, or blower wheels and housings because they have found BARRY a dependable, low cost source of supply.



Double Inlet Blower



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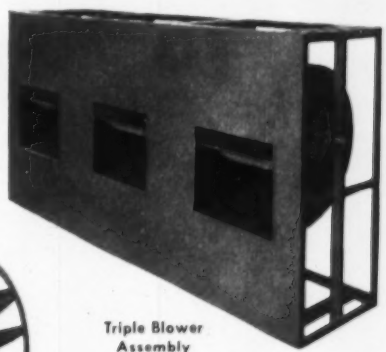
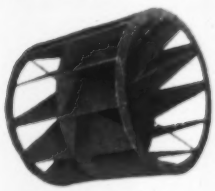
Single Inlet Backwardly Curved Wheel

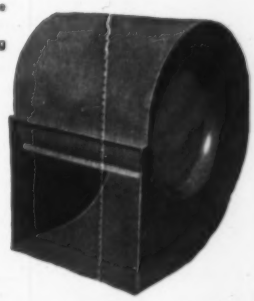


Triple Blower Assembly



Double Inlet Backwardly Curved Wheel

Double Inlet Housing



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MOST ADVANCED HEATER

The combustion chamber of an Olson is constructed of Austinetic Stainless Steel. Its floating design eliminates undue expansion and contraction stresses. Note the secondary heat transfer surface above, a multiple battery of 10 guage boiler tubes separated by stainless steel baffles providing a four pass counterflow gas travel. The extended flue gas travel and extra heat transfer surface insures high efficiency and safe metal temperatures and long dependable heater life. Write for complete information on Olson Heaters.

Olson

STAINLESS STEEL DIRECT FIRED HEATERS
Gas—Oil—Dual Gas and Oil—300,000 to 2,000,000 BTU
CANFIELD, OHIO
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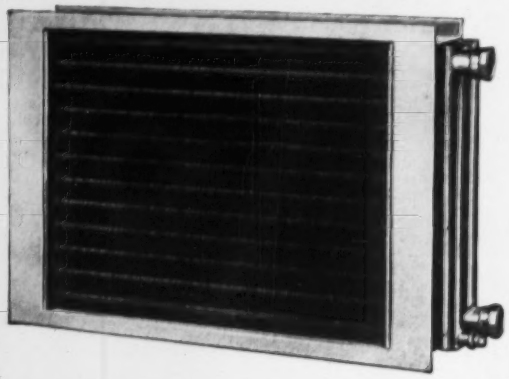
New . . . REMPE "Hi-Cap" STEAM HEATING COILS WITH DEFROSTER

For Use In Combination With Air Conditioning Coils Or As Tempering and Booster Units in Long Heating Ducts.



Available in Single Row Type with BTU per hour capacity from 60,000 to 360,000. In Double Row Type, for heavy duty service, in capacities from 129,000 to 775,000 BTU per hour. Heavy gauge steel casings. Copper tubes and headers. Tested 350 lbs. air pressure for steam working pressures up to 125 lbs. Defroster-standard equipment. Also suitable for hot water.

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REMPE CO. — REMPE COMPANY

342 N. Sacramento Blvd., Chicago 12, Ill.

Complete facilities for fabrication of pipe coils—all types—all materials. Engineering service. Send details for price.

MEETINGS & CONVENTIONS *Continued*

1956

NOV. 15-16—*National Association of Corrosion Engineers*, north central regional meeting. Hotel Statler, Detroit. NACE headquarters: 1061 M&M Bldg., Houston 2.

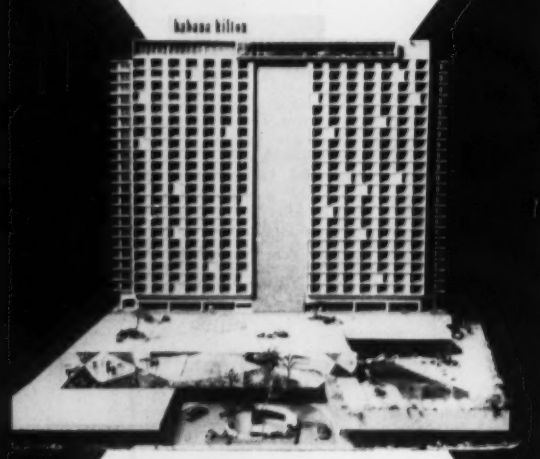
NOV. 15-18—*Refrigeration Service Engineers Society*, annual convention. Hotel Muehlbach, Kansas City, Mo. Headquarters: 435 N. Waller Ave., Chicago.

NOV. 25-28—*American Society of Refrigerating Engineers*, semi-annual meeting. Hotel Statler, Boston. Information: ASRE, 234 Fifth Ave., New York 1.

NOV. 25-30—*American Society of Mechanical Engineers*, annual meeting. Statler Hotel, New York. ASME headquarters: 29 W. 39th St., New York 1.

NOV. 26-29—*Refrigeration and Air Conditioning Contractors Association*, annual convention. Balmoral Hotel, Miami Beach. RACCA headquarters: 10660 Carnegie Ave., Cleveland 6.

The Magnificent New



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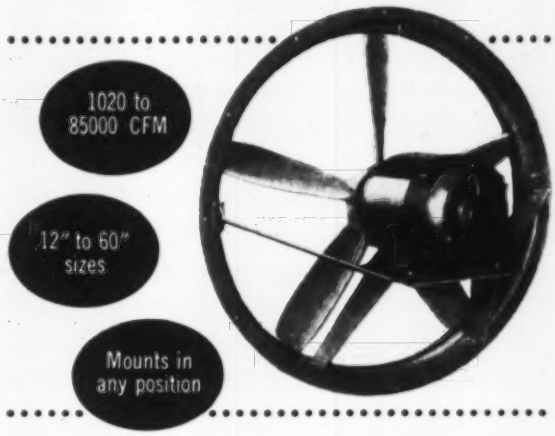

PROPELLAIR TYPE "CD" DIRECT CONNECTED FAN

Use this heavy-duty fan for ventilation . . . to exhaust heat, dust, moisture, fumes and smoke. It's powerful, dependable, efficient. Use it in ductwork, hoods, roof ventilators, wall mountings or for air circulation and cooling. Engineered to move a lot of air at low cost.

You get these important features:

- Cast aluminum airfoil propeller for greater efficiency
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- Venturi entrance ring with tip seal to create efficient air flow
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Certified Ratings — PMA

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SPRINGFIELD · OHIO

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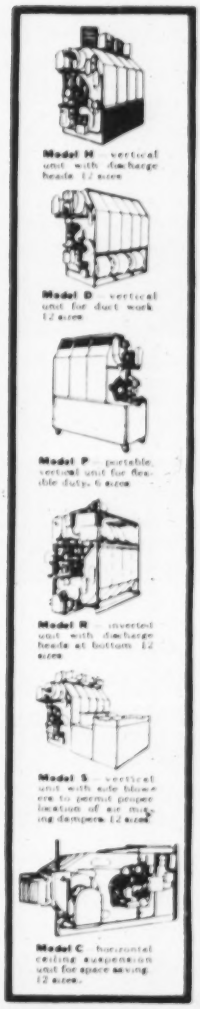
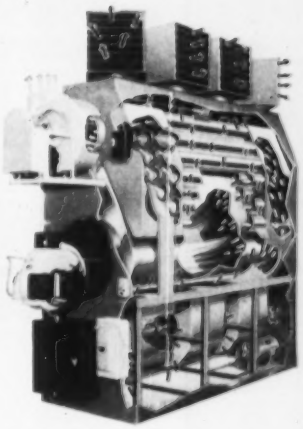

Model H — vertical unit with discharge heads 12 sizes.
Model D — vertical unit for duct work 12 sizes.
Model P — portable vertical unit for flexible duty, 6 sizes.
Model R — inverted unit with discharge heads at bottom 12 sizes.
Model S — vertical unit with auto blower ore to permit proper location of air mixing dampers 12 sizes.
Model C — horizontal ceiling suspension unit for space saving. 12 sizes.



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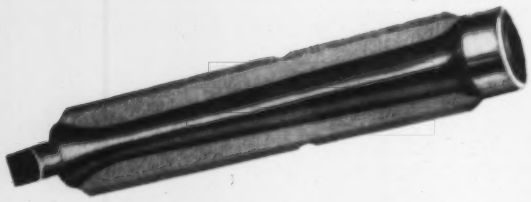

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Division of SURFACE COMBUSTION CORPORATION, *Toledo, Ohio*

MEETINGS & CONVENTIONS *Continued*

1956

NOV. 26-30—*22nd National Exposition of Power and Mechanical Engineering.* Coliseum, New York. Under auspices of American Society of Mechanical Engineers. Manager: E. K. Stevens, care of the Exposition, 480 Lexington Ave., New York 17.

NOV. 26-30—*Third International Automation Exposition.* Trade Show Bldg., New York. Management: Richard Rimbach Assoc., Inc., 845 Ridge Ave., Pittsburgh 12.

NOV. 26-30—*National Warm Air Heating and Air Conditioning Association,* committee meetings and annual convention. Netherland Plaza, Cincinnati. NWAHACA headquarters: 640 Engineers Bldg., Cleveland.

NOV. 27-30—*Ninth National Chemical Exposition.* Public Auditorium, Cleveland. Chicago Section of the American Chemical Society, 86 E. Randolph St., Chicago 1.

NOV. 28-30—*International Ozone Conference.* Sheraton Hotel, Chicago. Information: Sidney Mittler,

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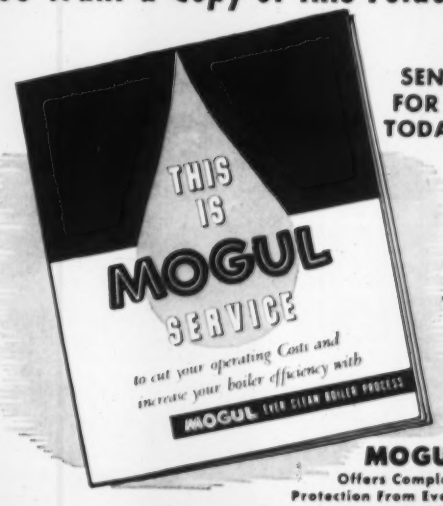
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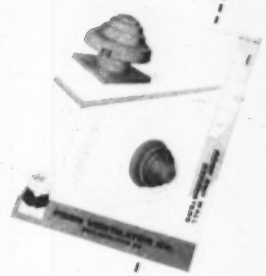
Penn's new Domex brochure, DMX18, has all the facts about centrifugal roof and wall mounted exhausters, as well as axial flow and relief Domex's. Your FREE COPY is available immediately.



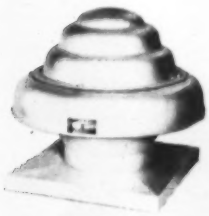


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FIG. 47 "C" CLAMP WITH LOCKNUT

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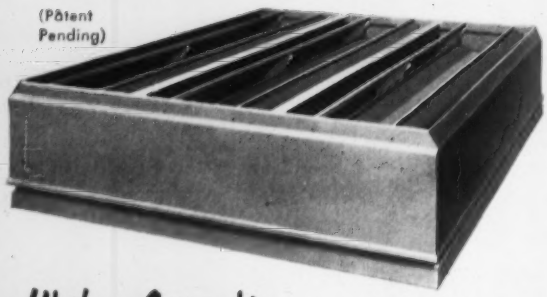
Contouramic Airmover® Roof Ventilator

(Patent Pending)



Higher Capacity

gravity ventilation now achieved with less bulk and weight . . .

and at lower cost!

You get fifteen years of research and scientific designing in this new Contouramic Airmover . . . and it shows up in the new size and shape . . . and a terrific boost in performance. It has automatic damper-opening in case of fire, too! Here is today's outstanding ventilator development.

Only 21½ inches high from the roof curb — nearly a foot lower — this new Airmover is lighter, easier to install, and absolutely wind-and-weather safe. Easier to clean and maintain. It's flexible as ever — single units for "spot" ventilation or single or double runs when you want your whole roof to breathe.

And contrary to today's trends, the cost is down! Write or wire for Form 312F today.

Here it is— summed up in ten outstanding features

1. Higher Capacity
2. Lower Cost
3. Easier to Install — and at Less Cost
4. Less Weight
5. Lower — only 21½" high
6. Less Wind Resistance
7. Automatic Opening in Case of Fire
8. Absolutely Weatherproof
9. Nylon Bearings
10. Lower Maintenance

18511 Euclid Avenue, Cleveland 12, Ohio

The Swartwout Co.

Roof Ventilators and Ventilating Louvers

AUTRONIC PROCESS CONTROL EQUIPMENT

MEETINGS & CONVENTIONS — *Continued*

1956

Armour Research Foundation, 10 W. 35th St., Chicago 16.

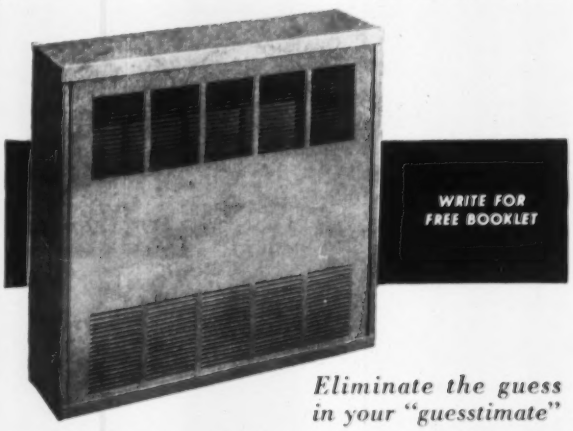
DEC. 3-5 — Air Pollution Control Association, semi-annual meeting, Rice Hotel, Houston. Information: Harry C. Ballman, executive secretary, APCA, 4400 Fifth Ave., Pittsburgh 13.

DEC. 4-5 — Seventh SPI Film, Sheeting and Coated Fabrics Division Conference, Commodore Hotel, New York. Society of the Plastics Industry, Inc., 250 Park Ave., New York 17.

1957

JAN. 21-22 — Today's Tool for Tomorrow's Research, symposium on solar furnace design and operation. Hotel Westward Ho, Phoenix. Sponsored by the Association for Applied Solar Energy, in conjunction with Stanford Research Institute, Arizona State College at Tempe and University of Arizona. Information: John I. Yellott, secretary of the association, 3424 N. Central Ave., Phoenix.

Convectors BY EMBASSY



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SPECIFY EASY TO INSTALL EMBASSY CONVECTORS

Note: For one pipe steam systems request large steel tubed elements.

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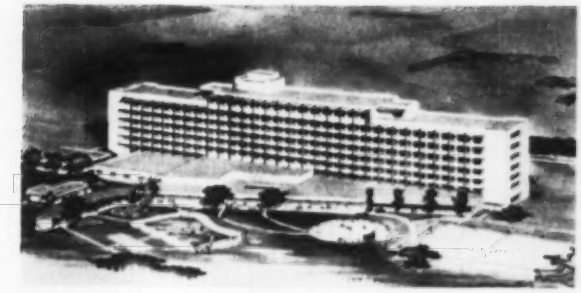


¡Extraordinario!

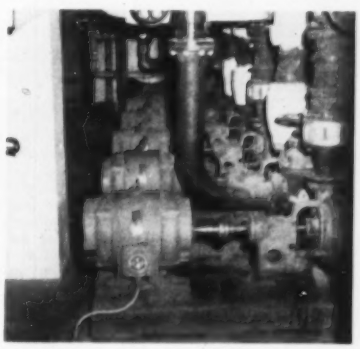
The air conditioned El Embajador built in only 205 days!

One of the finest new Caribbean hotels is El Embajador, located in Ciudad Trujillo, Dominican Republic. A luxurious resort with over 300 guest rooms, it was built (by Merritt-Chapman & Scott Corp.) in only 205 days —a major construction feat!

A 400-ton air conditioning system adds the final touch to this white-stuccoed *palacio*. And five Goulds pumps supply the means of circulating water through the system—a system which cools the guest rooms, penthouse, casino, dining room, night club, cocktail lounge, store area, and spacious lounge.

It's no wonder that Goulds pumps were specified for such a big job. The Goulds Fig. 3770 single-stage centrifugal is a perfect choice for circulating and transfer service. It's an economical pump that offers minimum mechanical losses—resulting in high operating efficiency with low power consumption.

You can put the same economical and dependable pumps into your own designs. Contact your nearest Goulds representative for more information on Goulds circulation pumps. Or write to us. Ask for Bulletin 622.



Five Goulds pumps circulate the water for El Embajador's air conditioning system. Each of the 200-HP refrigeration machines is served by two of these Goulds Fig. 3770-4D—one for chilled and one for condenser water. A fifth pump stands by—ready for immediate relief.

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48" x 120"	3/8" x 1/2"	870 gal.	1500 GPH

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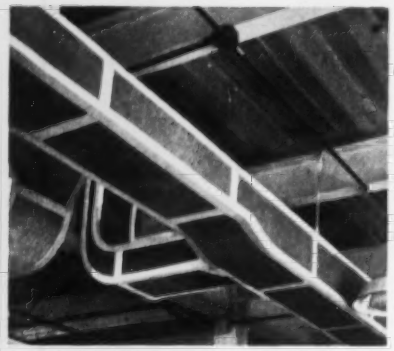

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MEETINGS & CONVENTIONS — *Continued*

1957

JAN. 28-31—*Eighth National Plant Maintenance & Engineering Show.* Public Auditorium, Cleveland. Information: Clapp & Poliak, Inc., 341 Madison Ave., New York 17.

FEB. 4-8—*American Society for Testing Materials,* committee week. Benjamin Franklin Hotel, Philadelphia. ASTM headquarters: 1916 Race St., Philadelphia 3.

FEB. 5-7—*12th SPI Reinforced Plastics Division Conference.* Edgewater Beach Hotel, Chicago. Society of the Plastics Industry, Inc., 250 Park Ave., New York 17.

FEB. 8-10—*Air Conditioning, Ventilating and Electric Space Heating Exposition.* Sheraton Park Hotel, Washington, D.C. Conducted by the Electric Institute of Washington, 10th and E Sts., N.W., Washington 1, D.C.

FEB. 18-21—*Sixth Annual Industrial Ventilation Conference.* Kellogg Center, Michigan State Univer

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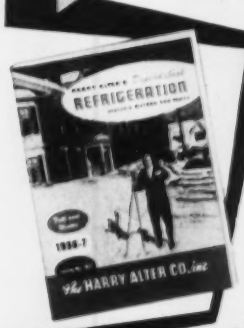

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MEETINGS & CONVENTIONS — *Continued*

1957

sity. Information: Industrial Ventilation Conference, Continuing Education Service, Michigan State University, East Lansing, Mich.

FEB. 25-28—American Society of Heating and Air-Conditioning Engineers, Inc., 63rd annual meeting. Conrad Hilton Hotel, Chicago. Information: A. V. Hutchinson, executive secretary, ASHAE, 62 Worth St., New York 13.

FEB. 25-MARCH 1—13th International Heating and Air-Conditioning Exposition. International Amphitheater, Chicago. Under management of International Exposition Co., 480 Lexington Ave., New York.

MARCH 11-15—National Association of Corrosion Engineers, annual conference and exhibition. Kiel Auditorium, St. Louis. NACE headquarters: 1061 M&M Bldg., Houston 2.

MARCH 18-21—Society of the Plastics Industry, annual national conference and Pacific Coast plastics exposition. Hotel Biltmore and Shrine Exposition Hall.

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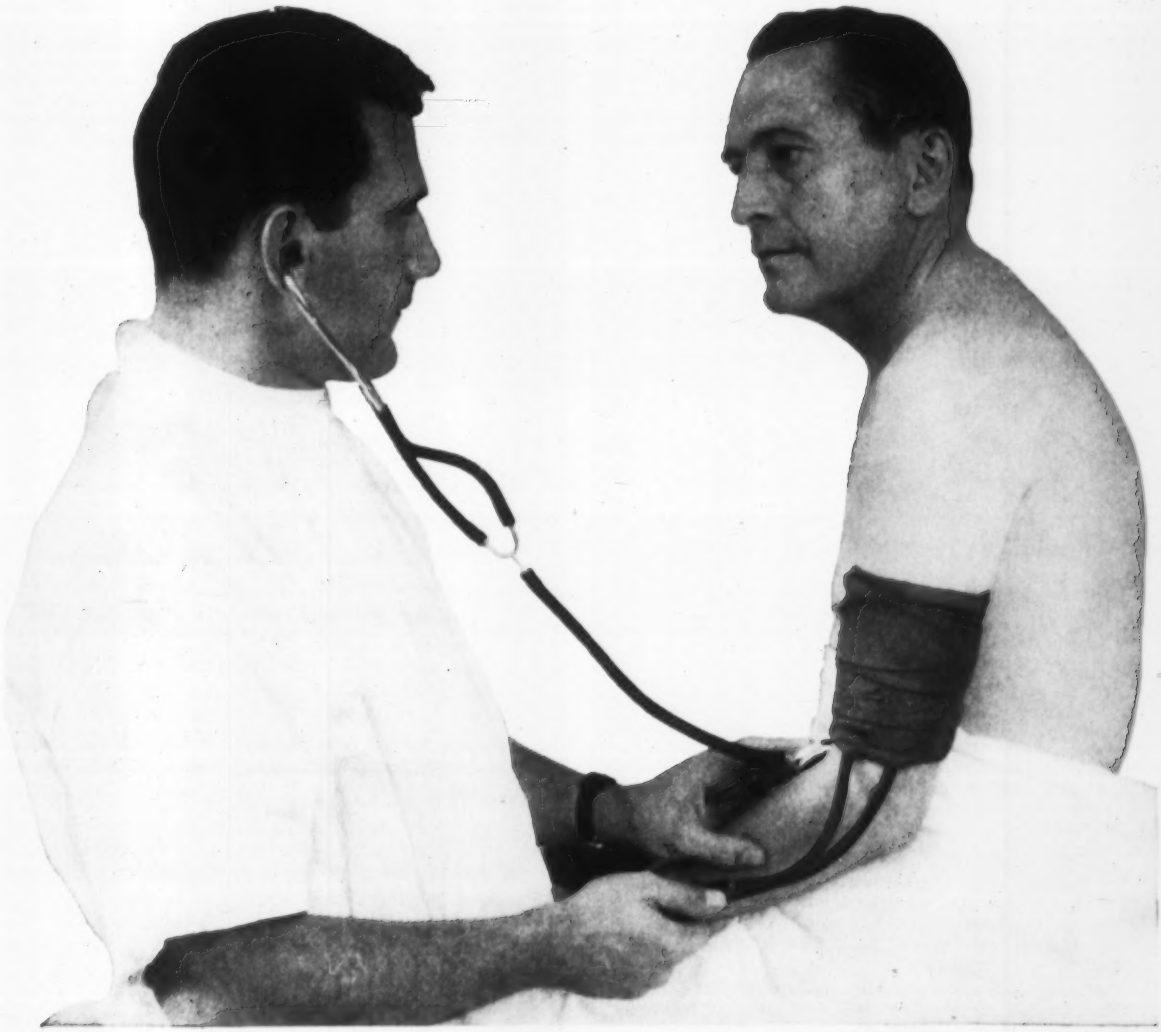

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MEETINGS & CONVENTIONS

Continued

1957

Los Angeles. SPI headquarters: 250 Park Ave., New York 17.

MARCH 27-29—*19th Annual American Power Conference*, Hotel Sherman, Chicago. Information: Illinois Institute of Technology, 35 W. 33rd St., Chicago.

APRIL 14-17—*Building Research Institute*, annual meeting. Edgewater Beach Hotel, Chicago. BRI headquarters: 2101 Constitution Ave., Washington 25, D.C.

APRIL 14-27—*United States World Trade Fair*. Coliseum, New York. Information: United States World Trade Fair, 331 Madison Ave., New York.

MAY 6-8—*Air-Conditioning and Refrigeration Institute*, annual meeting. The Homestead, Hot Springs, Va. ARI headquarters: 1346 Connecticut Ave., N.W., Washington 6, D.C.

MAY 7-10—*Mechanical Contractors Association of America*, annual meeting. Hotel Fontainebleau, Miami Beach. The association is at 30 Rockefeller Plaza, New York 20.

MAY 20-24—*National Fire Protection Association*, annual meeting. Hotel Statler, Los Angeles. NFPA headquarters: 60 Batterymarch St., Boston.

JUNE 2-5—*American Society of Refrigerating Engineers*, annual meeting. Hotel Fontainebleau, Miami Beach. ASRE headquarters: 234 Fifth Ave., New York.

JUNE 3-6—*National District Heating Association*, 44th annual meeting. The Homestead, Hot Springs, Va. Information: John F. Collins, Jr., secretary-treasurer, NDHA, 827 N. Euclid Ave., Pittsburgh.

JUNE 16-21—*American Society for Testing Materials*. Chalfonte-Haddon Hall, Atlantic City. ASTM headquarters: 1916 Race St., Philadelphia 3.

JUNE 24-27—*American Society of Heating and Air-Conditioning Engineers, Inc.*, semi-annual meeting. Murray Bay, Quebec. Information: A. V. Hutchinson, executive secretary, ASHAE, 62 Worth St. New York 13.

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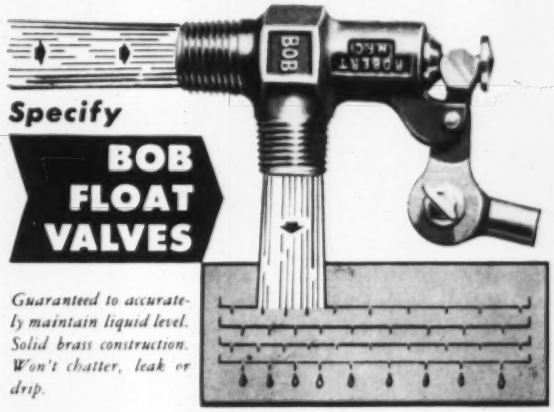

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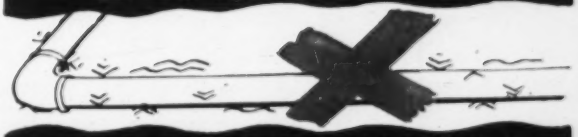

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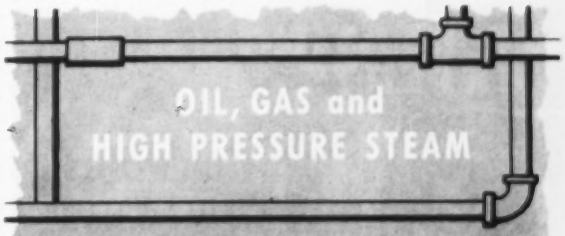

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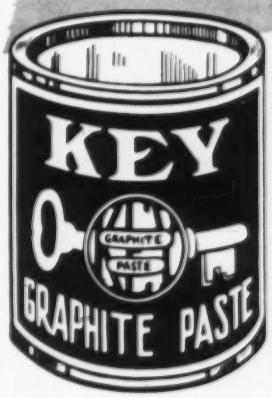

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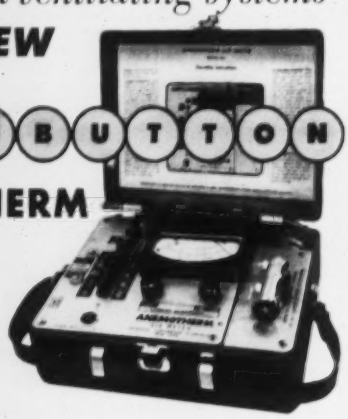

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MEETINGS & CONVENTIONS — *Continued*

1957

AUG. 11-15—First National Conference on Applied Heat Transfer. Pennsylvania State University, University Park, Pa. Sponsored by heat transfer division and central Pennsylvania section of American Society of Mechanical Engineers in cooperation with College of Engineering and Architecture of the University. ASME headquarters: 29 W. 39th St., New York 18.

NOV. 14-16—American Society of Refrigerating Engineers, semi-annual meeting. Morrison Hotel, Chicago. ASRE headquarters: 234 Fifth Ave., New York.

NOV. 18-21—10th Exposition of the Air-Conditioning and Refrigeration Industry. International Amphitheater, Chicago. Air-Conditioning and Refrigeration Institute, 1346 Connecticut Ave., N.W., Washington 6, D.C.

NOV. 18-22—National Warm Air Heating and Air Conditioning Association, committee meetings and annual convention. Morrison Hotel, Chicago. NWAHACA headquarters: 640 Engineers Building, Cleveland 14.

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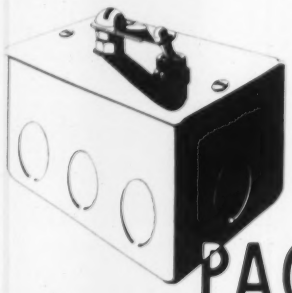

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The following is a statement of ownership, management, etc., as required by the act of Congress of August 24, 1912, as amended by the acts of March 3, 1933 and July 2, 1946 (Title 39, United States Code, Section 233) of Heating, Piping & Air Conditioning, published monthly at Chicago, Ill., for October 1, 1956:

1. The names and addresses of the publisher, editorial director, editor, and president are:

Publisher, Chas. E. Price, Glencoe, Illinois.
Editorial Director, C. M. Burnam, Jr., Chicago, Illinois.
Editor, Robert W. Roose, LaGrange, Illinois.
President, Chas. E. Price, Glencoe, Illinois.

2. The owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual member, must be given.)

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3. The known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are: None.

4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

Chas. E. Price, President

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(SEAL) [My commission expires November 22, 1959]

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CHEMICAL PROCESS INDUSTRIES—Second Ed. By L. Norris Shreve. 1004 pp. McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36. $11.50.

DEVELOPMENTS IN STAINLESS-STEEL WELDING IN THE NUCLEAR PROGRAM—By E. B. LaVelle, L. H. Rasmussen and E. M. Kuchera. 19 pp. Publication TID-8013. Office of Technical Services, Department of Commerce, Washington 25, D.C. 20c.

METALLIZING BIBLIOGRAPHY—Publication C2.5-1956. 35 pp. American Welding Society, 33 W. 39th St., New York 18. $1.50.

STACK SPRAY DUST COLLECTORS—By Loy A. Updegraff. 8 pp. Bituminous Coal Research, Inc., 121 Meyran Ave. at Forbes, Pittsburgh 13. 25c.

INDIRECT EVAPORATIVE COOLING SYSTEMS—Holmes & Narver, Inc., 828 S. Figueroa St., Los Angeles 17.

VERMICULITE FIRE RESISTANCE RATINGS FOR PLASTER, ACOUSTICAL PLASTIC, AND CONCRETE—Vermiculite Institute, 208 S. LaSalle St., Chicago 4. ‡

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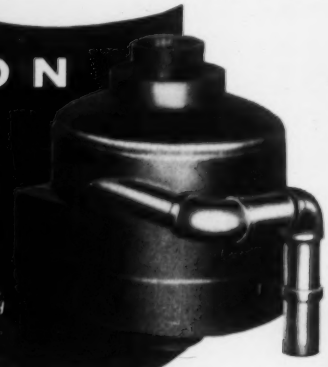

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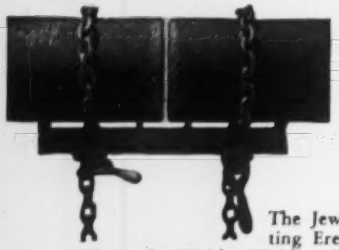

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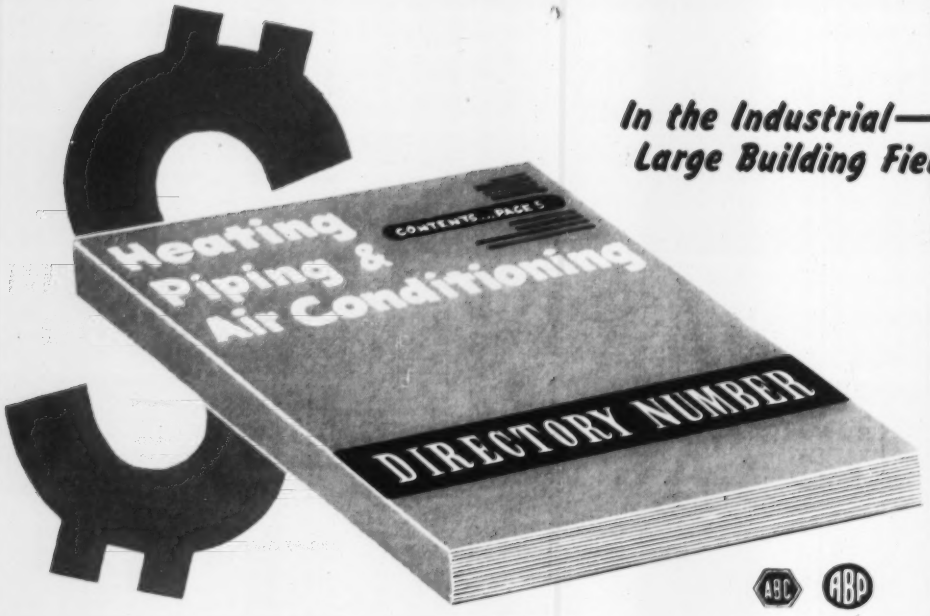

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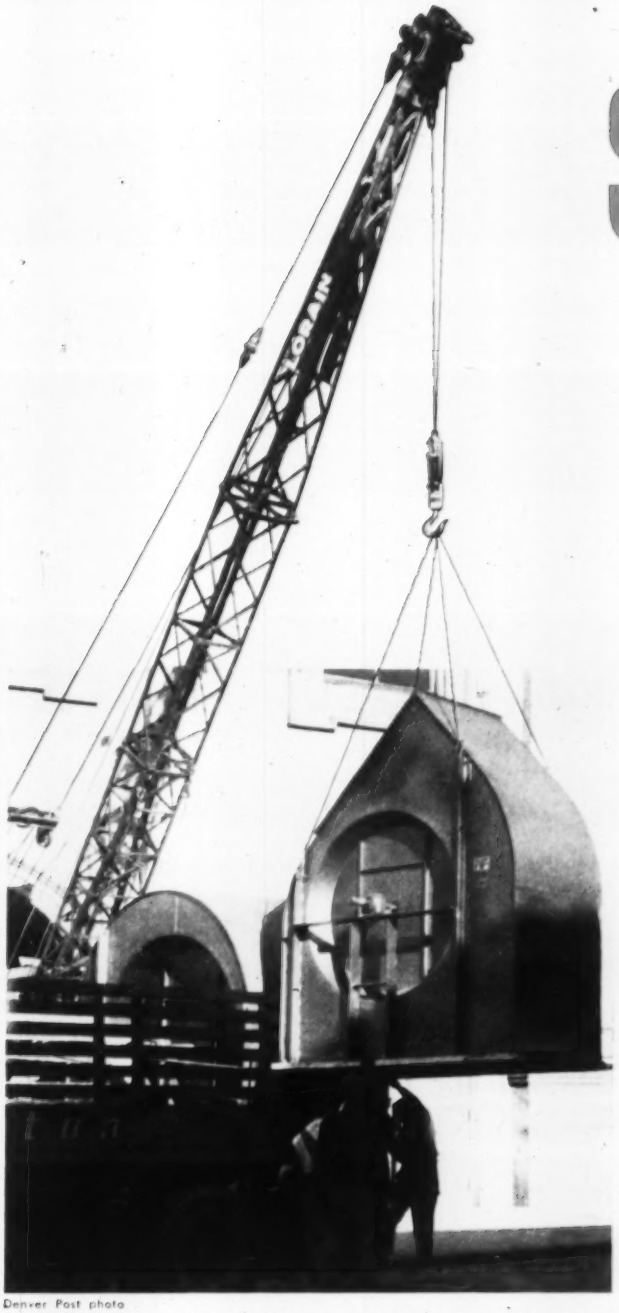

Denver Post photo

Owner: City of Denver. Architect: G. Meredith Musick. General Contractor: Newstrom-Davis & Company. Heating, Ventilating and Air Conditioning Contractor: Trautman & Shreve, Inc. Structural Engineer: Phillips-Carter-Osborne, Inc.

SETTING THE STAGE

for a Better Breathing Denver Auditorium

Another ventilating assignment for Clarage. One of the features of the remodeled Denver City Auditorium is a new "respiratory system", using these Clarage Type HV Fans and a Clarage Type V Air Washer.

Here, as in so many other notable buildings the nation over, Clarage equipment was chosen for its recognized ability. Quiet . . . economical . . . and, most assuredly, dependable.

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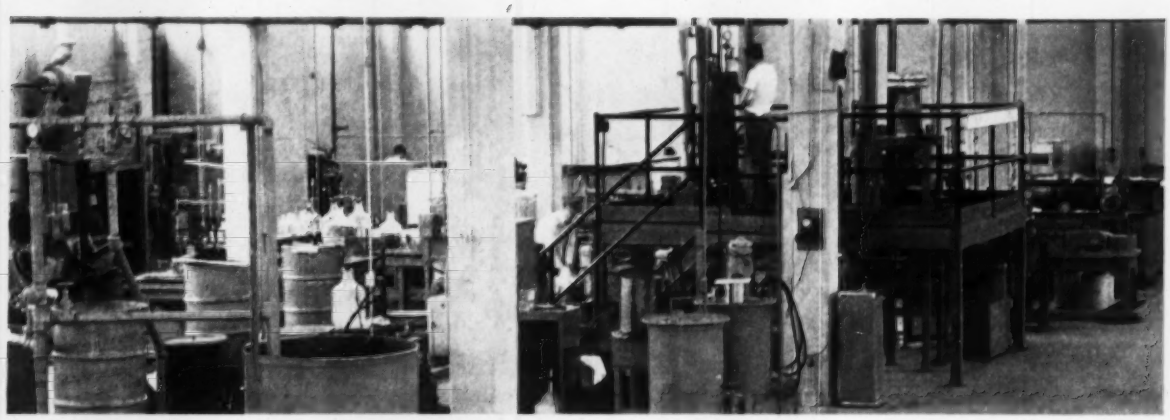
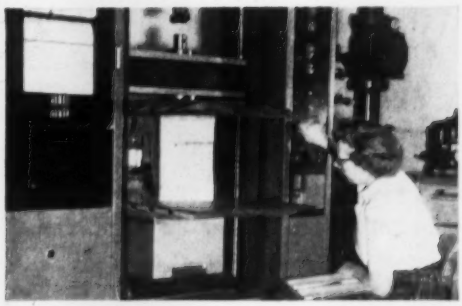
Research Laboratory, The Mead Corporation, Chillicothe, Ohio. Lorenz & Williams, architects, Dayton; Schweiger Heapy & Asscoiates, mechanical engineers, Dayton.

Control Flexibility-

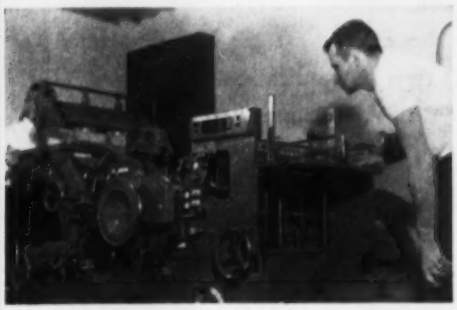
• It's a "must" when you have diversified temperature and humidity requirements



Strategically located Johnson Thermostats operate Valves and Dampers on six large heating and ventilating units serving the spacious pilot plant laboratory.



Stress and strain breaking points of Mead carton stock are tested in a constant temperature and humidity room. Perfectly conditioned air is supplied by a built-up air conditioning unit under the highly accurate control of a Johnson Recorder-Controller.



Printing research is among other activities conducted under carefully controlled temperature and humidity conditions. Sensitive Johnson Room Thermostats, controlling mixing dampers on a central double duct air conditioning system, produce the exact conditions required.

The extensive research and development program of The Mead Corporation, one of the nation's leading papermakers, offers an interesting example of the varied temperature and humidity control needs of today's industrial buildings. At Mead, these include:

- Control of a central double duct air conditioning system serving laboratories, offices, library and public areas.
- Control of a separate air conditioning unit for a constant temperature and humidity laboratory (temperature, 75°F; rel. humidity, 50 per cent).
- Control of a variable temperature and humidity test room to maintain any temperature from 50° to 100°F and any relative humidity from 20 to 80 per cent.
- Control of combination heating and ventilating units for a pilot plant laboratory.
- Weather-compensated control of the hot water baseboard radiation system.

A Johnson-engineered Pneumatic Control System easily provides the necessary flexibility to satisfy each one of these requirements . . . *and with a precision that insures virtually waste-free heating, cooling and ventilating operation!*

This system, like the Johnson Systems in countless other buildings of all types and sizes, was designed and installed to meet the exact needs of the individual building. Regardless of how complex or diversified your control problems may be, you can count on this tradit'onal Johnson policy to provide you with an equally successful control system.

Next time you have a temperature, humidity or process control problem, talk to an engineer from the specialist Johnson organization. His recommendations are yours without obligation. Johnson Service Company, Milwaukee 1, Wisc. Direct Branch Offices in Principal Cities.

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